The Correlates of Subordination

Transaction Costs and the Design of Military Alliances, 1815-2003

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Abstract

Security relationships between states can be categorized as more or less hierarchical. Some relationships are characterized by dominance and subordination, while others are highly egalitarian. Why relationships vary along this continuum has never been studied quantitatively in the International Relations literature. In this thesis I set out to test the most popular and well-developed theory on this subject, namely the *transaction-cost theory of international security relationships*. Using a range of variables and datasets from the quantitative International Relations literature, I have developed a research design to test the empirical implications of the transaction-cost theory on the subject of the design of military alliances. Some alliances are designed with hierarchical safeguards that allow a powerful state to restrict the autonomy of a weaker ally, and the transaction-cost theory should be able to account for these alliances. Using a logistic regression model, I have investigated the effects of transaction-cost variables on the choices of alliance design. I find that most of the hypotheses that are derived from the transaction-cost theory are discarded. Meanwhile, a model that includes successful transaction-cost variables offers significant explanatory and predictive power, and is a substantial improvement on a baseline model of variables derived from more mainstream International Relations theory. My analysis provides new and valuable knowledge about which factors are decisive in pushing the governance of security relationships in a hierarchical direction. It seems that powerful states` fears of being pulled into unwanted conflicts, institutional dissimilarity, previous colonial relationships, and asymmetries in size and material power go a long way in explaining why some states end up in hierarchically organized military alliances.

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All flaws in this thesis are my own.

Tore Wig

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Table of contents

1. Introduction 12
   1.1 The puzzle and its relevance 13
   1.2 The structure of the thesis 14
   1.3 Findings 16
2. Hierarchical relationships in international politics 17
   2.1 The concept of hierarchy in International Relations theory 17
   2.2 The varieties of hierarchical organization 24
   2.3 Summary 27
3. Theory 28
   3.1 The transaction-cost theory of firms 28
   3.2 The transaction-cost theory of international security hierarchies 34
   3.3 The application of the theory to military alliances 45
   3.4 Summary 47
4. Research design 48
   4.1 The case for a statistical analysis 48
   4.2 Dataset and unit of analysis 49
   4.3 From theoretical model to proxy variables 52
   4.5 Independent variables 59
   4.6 Control variables 73
   4.7 Statistical model 76
   4.8 Missing values 78
   4.9 Summary 78
5. Results 80
   5.1 The logic of the empirical analysis 80
   5.2 Presentation of results 82
   5.3 Overall model performance 87
   5.4 Summary 92
6. Robustness tests 93
   6.1 Highly correlated independent variables 93
   6.2 Model specification 94
   6.3 Non-independent observations 95

6.4 Outliers and influential cases 96
6.5 Alternative operationalization of hierarchy 98
6.6 Summary: A second look at the results 99
7. Concluding discussion 100
7.1 Non-findings and their implications 101
7.2 A tentative case for the transaction-cost theory 102
7.3 Summary and conclusions 104
Bibliography 107
Appendix 1 – Additional results 117
Appendix 2 – Relevant Stata (v.11) code for all the analyses 125

Tables

Table 1 - Different understandings of hierarchy in IR 23
Table 2 - Sample of alliances with values on the dependent variable 58
Table 3 - Data source and operationalizations of the transaction-cost variables 73
Table 4 - Descriptive statistics for main variables 77
Table 5 - Logistic regression of the determinants of alliance design 83
Table 6 - Change in probability when each variable increases from its mean to its maximum value 85
Table 7 - Comparative performance of successful transaction-cost variables 88
Table 8 - Out-of-sample predictive power 91
Table 9 - Overview of missing values 117
Table 10 - Univariate tests of independent variables 118
Table 11 - Trivariate tests of interaction terms 119
Table 12 - Result of inclusion of irrelevant single variables in full model 120
Table 13 - Inclusion of relevant interaction terms in the full model 120
Table 14 - Variance inflation factors for variables in efficient model 121
Table 15 - Models with alternative dependent variable operationalization 122
Table 16 - Regression with robust standard errors and time dummies 123
Table 17 - Models with influential cases and outliers removed 124

Figures

Figure 1 - The anarchy-hierarchy continuum 25
Figure 2 - A transaction-cost model of economic governance 33
Figure 3 - The transaction-cost model of security hierarchies 45
Figure 4 - The transaction-cost model of alliance design (with proxy variables) 75
Figure 5 - In-sample predictive performance of risk attitude, regime dissimilarity, and colonial contiguity 91
Figure 6 - In-sample predictive power of size, colonial history and power asymmetry 92

1. Introduction

- *Why is there any organization?* – Ronald Coase, 1937[1]

Relationships of dominance and subordination do not stop at state boundaries but are enduring features of international politics. Hierarchical structures of organization, like empires, protectorates, colonies, and de facto imperial relationships, where the autonomy of a weaker party is curtailed by a dominant actor, are familiar to any student of international history. The question of why some relationships between states are hierarchical while others are egalitarian has been widely covered in the historical literature and in case studies, but it has received surprisingly little attention in the quantitative International Relations literature (referred to as IR from now on).

My thesis has set out to operationalize and test what I will here refer to as the *transaction-cost theory of international security hierarchies*, which is one of the most popular and well-developed theories of the subject. A general formulation of this theory states that hierarchical security relationships are chosen when there are benefits to be had from cooperation between two parties and these benefits are jeopardized by a high likelihood of opportunistic behavior, and/or by sudden external shocks. Such problems are particularly acute in the domain of international politics where there is no global government, and thus no strong third-party enforcement to make sure that agreements between states are upheld. When the costs of opportunism and uncertainty are high, and the expected costs of maintaining a hierarchical governance structure are low enough, the theory states that such a structure will be chosen to limit the costs of opportunistic behavior and external shocks. In short, a hierarchical structure is expected to be established when the benefits from coordinating behavior can be realized in no other way.

In this thesis, I have developed a research design to test the propositions of the transaction-cost theory in the empirical domain of military alliances. I argue that the transaction-cost theory should perform well when applied to this domain, since some alliances are hierarchically designed, while others are egalitarian in form. Using a statistical analysis I have tested the main implications of the transaction-cost argument on a dataset of military alliances, covering the period from 1815 to 2003.

[1] Coase (1937, 388)

1.1 The puzzle and its relevance

Patterns of dominance and subordination are often considered as natural and constant companions to human affairs. After all, human beings, even collectivities, are by many assumed to harbor a natural inclination towards dominating others, an internal "animus dominandi" as Hans Morgenthau famously phrased it (1946, 192). Yet, a constant like human nature cannot explain a pattern of variation, and insofar as some states dominate while others are subordinated in hierarchical modes of organization, the question remains as to why. The puzzling nature of this question becomes clearer when one grasps the fact that constructing a hierarchical governance structure, like an empire, a colony, or a hierarchical military alliance is *costly* for both parties. If state A is stronger than state B, and if it can get B to do A`s bidding without establishing a hierarchical structure to bind the subordinate actor to its will, it will be rational for state A to avoid this cost. Furthermore, it will be rational for state B to give A what it wants before A finds it beneficial to integrate B in a hierarchical structure. In this case, a hierarchy is a *suboptimal* outcome, since the distribution of gains and losses realized in a hierarchy could be realized in principle with less cost to both outside a hierarchy. The question then becomes; why are there any hierarchical governance structures at all?

The puzzle can be understood better by way of an analogy with economics, where the transaction-cost theory has its origin. In 1937 the economist Ronald Coase looked at the market economy and asked «why is there any organization?» (1937, 388). Coase was puzzled by the fact that some economic transactions were done in the marketplace, by economic actors with no other relation to each other than that of seller and buyer, while other transactions were done internally in hierarchically organized institutions called firms. Why some transactions were taken out of the market and internalized in firms was unexplained by the conventional economic theory of Coase`s time (Coase 1937).

The question posed by Coase has recently been asked in the domain of international security, as scholars have begun to investigate why some security relationships are organized hierarchically while others are organized in an egalitarian fashion. The transaction-cost theory of international security hierarchies constitutes an attempt at solving this puzzle. This theory has been applied to security relationships by Lake (1996, 1999, 2001), Weber (1997, 2000), Leeds (2000), Haftendorn, Keohane and Wallander (1999), Cooley (2005), and Cooley and Spruyt (2009), and it has been applied to international cooperation more generally (Koremenos 2005; Koremenos, Lipson, and Snidal 2001; Leeds 2000).

Broadly construed, the transaction-cost theory of security hierarchies rests on three main claims. First, it claims that international relationships fall along a continuum, ranging from egalitarian relationships, via moderately hierarchical military alliances or more informal hierarchies, to structures that are more visibly hierarchical like protectorates, colonies and empires. Secondly, it states that a hierarchical security relationship will be established whenever the benefits of security cooperation cannot be realized without a hierarchical governance structure that *changes the incentives and opportunities* of one or more of the parties. Such a structure will be in demand whenever there are benefits to be had from pooling security that cannot be realized without curbing the costs of opportunistic behavior, and unexpected shocks. In addition to being one of the most popular theories on this subject, the transaction-cost theory is also the theory that has received the most empirical scrutiny. This scrutiny however, has only taken the form of qualitative case-studies, an imbalance which this thesis seeks to rectify.

I will argue that the transaction-cost theory of international security hierarchies can be tested in the domain of alliance-design. The reason for this is, as we shall see, that some alliances are organized in a hierarchical fashion, while others are egalitarian in form. The study of military alliances has been a growth industry in the field of International Relations (IR from now on) research for years, yet little systematic effort has been made to study why alliances differ in terms of hierarchical versus non-hierarchical design, in spite of the fact that such differences are easy to identify.

The hypothesis that we can derive from the transaction-cost approach is that alliances will be organized hierarchically in relationships where there are high potential costs of opportunistic behavior, high non-behavioral uncertainty, a high expected frequency of interaction, and low costs of maintaining the governance structure. A hierarchical structure is designed by the more powerful state to restrict the autonomy of the weaker state.

1.2 The structure of the thesis

This thesis will proceed in several stages. In chapter 2, I will present a brief survey of the theoretical literature on the concept of hierarchy in IR, and I will show how theories of international hierarchy can be tested on the subject of military alliances. This will situate my *explanandum* – international security hierarchies – in the broader context of IR theory. First, I will argue that there are two general understandings of the concept of hierarchy in the literature; one that conceptualizes hierarchy in terms of asymmetries in power, and one that conceptualizes it as a relationship of political authority. As will be made clear, the latter approach is the most fruitful for the purposes of this thesis.

Second, I will present the anarchy-hierarchy continuum, and how this is expressed in different kinds of interstate relationship. I will here argue that hierarchical military alliances constitute one type of hierarchical organization.

In chapter 3, I will present the transaction-cost argument as an attempt to explain international security hierarchies. By drawing on the works of David Lake (1996, 1999, 2001), Katja Weber (1997, 2000), the original transaction-cost economics of Williamson (1973, 1975, 1979, 1981, 1985), and to some degree on Leeds (2000), I will present a unified transaction-cost theory of international security hierarchies. This presentation will be coupled with a discussion of why a quantitative test of the theory in the empirical domain of military alliances is appropriate.

In chapter 4, I will present a research design where I derive operational proxy measures for the theoretical concepts in the transaction-cost theory. I will argue that many familiar variables from quantitative IR research can be linked to the theoretical concepts in the transaction-cost theory, and that a broad range of expectations for the performance of these variables can be derived from the transaction-cost model. My argument for this research design is that, even though most of these variables are fairly rough measures of the concepts in the transaction-cost theory, there are major problems of accurate operationalization, and inherent problems when it comes to testing a transaction-cost theory statistically, we should expect to see that variables derived from the transaction-cost model, and that cannot be interpreted in any other coherent theoretical framework, will offer added explanatory power. If variables rooted in transaction-cost theory yields better explanatory power, this will provide an important platform on which to build further research efforts on this topic.

In chapter 5, I have tested the theory using a logistic regression analysis of allied dyads and their choice of alliance-design from 1815 to 2003. This is both a theory-testing and a model-building exercise. First, I have tested the hypotheses linked to each of the variables, and evaluated the overall explanatory strength of each component in the transaction-cost argument. Secondly, I have identified a parsimonious statistical model that can be used as a model in further research on this topic. Thirdly, I have evaluated whether or not the transaction-cost theory yields added explanatory and predictive knowledge when compared to a baseline explanatory model of variables derived from other explanations from more mainstream brands of IR theory. In chapter 6, I have tested the results for robustness to alternative variable- and model specifications, and to subtle changes in research design. Since this is the first quantitative study of this question, meaning that the fruitful results identified here can be used in future research, it is very important to subject the results to extensive robustness tests, to make sure that the results are stable properties of the data, and not simply arbitrary products of the particular research design.

1.3 Findings

The results in my study do not offer a clear-cut rejection or confirmation of the transaction-cost model. I find two interesting patterns in the data. First, I find that most of the hypotheses derived from the transaction-cost model are rejected. This either indicates that the transaction-cost model is a weak theoretical explanation of international hierarchies, or that it requires better theoretical models, operationalization and data than we currently have. Secondly, I find that a group of successful transaction-cost variables offers improved explanatory and predictive power when compared to a baseline model of variables derived from other plausible explanations in IR. These results are hard to interpret in other theoretical frameworks than the one proposed by the transaction-cost model.

In the end, we are left with a powerful statistical model of hierarchical alliance-design which seems robust to alternative modeling choices, and that yields both predictive and substantive explanatory power. This model indicates that stronger states` fears of entrapment in unwanted conflicts, institutional dissimilarity, previous colonial relationships, and asymmetries in the size and material power of states all push in the direction of hierarchical organization.

2. Hierarchical relationships in international politics

- International hierarchies are pervasive. Both in the past and present, states subordinate themselves in whole or part to the authority of other, dominant states. - David A. Lake, 2009[2]

This chapter consists of two parts. The first part is a short literature review that will situate my general *explanandum* – hierarchically organized security relationships – in the context of the theoretical IR literature. In the second part I will discuss how military alliances can be seen as instances of hierarchically organized security relationships. This chapter will set the stage for a presentation of the explanatory theory in chapter 3.

2.1 The concept of hierarchy in International Relations theory

I will here present some key currents of IR theory, and discuss how they have handled the concept of hierarchy. I will argue that there are two dominant understandings of hierarchy; one that conceptualizes it as asymmetries in economic or military *power*, and one that conceptualizes it in terms of political *authority*.[3] I will show how these differing understandings of hierarchy have logical implications for whether or not one should view hierarchical relations as important features of international politics. It will be made clear that an understanding of hierarchy as relationships of political authority, that rest on explicit or implicit bargains between partly rational actors, provides us with a conceptual foundation for the transaction-cost theory of hierarchy, and it is thus best suited as a conceptual starting point for this thesis.

2.1.1 Hierarchy as asymmetry of power

The first way in which hierarchy has been understood in the IR literature is as the asymmetry of *power*. Scholars who conceptualize hierarchy in this way differ in emphasizing the economic ore the military aspects of power. On this understanding, two actors find themselves in a hierarchy whenever one of them has more power than the other. *Power* has many definitions. One of the most cited ones is given by Robert Dahl, who defines it in this way: “A has power over B to the extent that he can get B to do something that B would

[2] Lake 2009b, 2

[3] I am not claiming that all of the authors reviewed fall neatly into one of these categories, neither am I claiming that the categories mentioned exhaust the spectrum of possible understandings of hierarchy. It is a matter of belonging more to one category than to another, and the categories mentioned are constructed to get a firmer analytical grip on a sometimes bewildering array of theoretical arguments.

otherwise not do" (Dahl 1957, 202-203). This definition is contested, but it suffices as a basic definition to use when discussing the concepts of power, coercion and authority as I will do below.[4]

The view that hierarchy is synonymous with disparities in military-, and economic power is poignantly expressed by Ian Clark who writes that hierarchy is a "social arrangement characterized by stratification in which, like the angels, there are orders of power and glory and the society is classified in successively subordinate grades" (1989, 2). On this account, the claim that the international system is hierarchically organized is trivially true, since there are obvious disparities between states in military and economic power. The ordering implied by the view of hierarchy as asymmetries in *military power* yields the categories of great, medium and small powers (Clark 1989, 2), while the ordering implied by the view of hierarchy as asymmetries in economic power yields the categories of the first and third world (Clark 1989, 2).

The realist tradition in IR theory puts a heavy emphasis on the disparities between nations in terms of military power. This emphasis can be traced as far back as to the ancient Athenians who, when the citizens of the militarily inferior island state of Melos pleaded with Athens to refrain from invading them, replied that "justice is what is decided when equal forces are opposed, while possibilities are what superiors impose and the weak acquiesce to." (Thucydides 1998, 313). The view finds a more contemporary expression in the tradition of classical realism (Morgenthau 1948, 48), but it does not amount to an explicit theory of hierarchy as such. As I will discuss below, the most recent major contributions to realism – often referred to as neorealism (Mearsheimer 2001; Walt 1987; Waltz 1979) – play down the importance of hierarchy, and emphasize the anarchic nature of the international system.

One group of realist scholars who emphasize hierarchy and view it as stratification in terms of military power can be found among the proponents of *hegemonic realism* (reviewed in DiCicco and Levy 1999). Hegemonic realist theories include the *power transition theory* (Kugler and Lemke 1996; Organski 1958; Organski and Kugler 1980), Gilpin`s *theory of hegemonic war* (Gilpin 1981), and *long cycle theory* (Modelski 1987).[5] The hallmark of this

[4] For a critical discussion of definitions of power see Lukes (2005). Kenneth Waltz has produced an alternative definition, where an agent is defined as powerful "to the extent that he affects others more than they affect him" (Waltz 1979, 192), while Barnett and Duval define it as "the production of particular kinds of effects, namely those on the capacities of actors to determine the conditions of their existence" (2005, 42) .

[5] *Hegemonic stability theory* (Keohane 1984) shares with hegemonic realism the central assumption of *one* preponderant actor residing at the summit of an international hierarchy. This theory is less explicitly a theory of hierarchy, and more a theory of international economic governance. I will therefore not pay too much attention to it here.

brand of realism is that it views the international system as a hierarchy where one preponderant power is placed at the summit of an international system that is geared to work in favor of the interests of that dominant power (Gilpin 1981, 28; Kugler and Lemke 1996, 8). In most hegemonic realist theories, hierarchy is primarily operationalized as asymmetries in raw material power (Kugler and Lemke 1996).[6]

Another group of scholars emphasize asymmetries in economic power. This view can be found in the related and often overlapping theories of *dependency theory*, *world systems theory*, and Galtung`s *structural theory of imperialism* (Galtung 1971). These theories claim that the international system is divided into economic cores, populated by highly developed countries, and economic peripheries, populated by underdeveloped countries (Cardozo and Faletto 1979; Frank 1979; Galtung 1971; Wallerstein 1974). This structure is permeated by hierarchical relations between core states and peripheral territories, where the core states extract the surplus of production from the peripheral territories largely as a result of their economic preponderance (Galtung 1971). To summarize, both the hegemonic realists who emphasize asymmetries in military power, and the authors who emphasize asymmetries in economic power, use the concept of hierarchy to refer to de facto economic or military stratification in the international system. It is easy to claim that hierarchy is a prominent feature of international politics when hierarchy is defined in these terms, since inequalities in power and wealth are salient features of international politics.

2.1.2 Hierarchy as a relationship of authority

The second way in which hierarchy has been understood is as a relationship of political authority. Lake (2009b, 17-24) provides us with a usable definition of political authority. Drawing on Dahl`s definition of power, he defines authority as a form of political power distinct from, but related to, coercion. Where coercion is the capacity of A to threaten B to do something B would otherwise not do, authority is the capacity of A to get B to do something it would otherwise not do because B recognizes an *obligation* to do so, and a corresponding right of A to punish B if it does not do it (Lake 2009b, 17-24). In the words of Robert Dahl:

> Authority is a matter of the *right* to command, and the correlative obligation to obey the person who issues the command. It is a matter of doing what he tells you *because he tells you to do it*"

[6] It should be noted that hegemonic realism acknowledges a hierarchical differentiation that is not *solely* defined in terms of power. Its focus on rules and practices that benefit the most powerful state (Di Cicco and Levy 1999, 682,684-685), and its stress on the similarity between international and domestic systems (DiCicco and Levy 1999, 682; Gilpin 1981, 28), implies a definition of hierarchy that goes one step further than treating power differentials as coextensive with hierarchy.

(Dahl 1989, 42, emphasis original).

Coercion and authority are related, because authority rests on the capacity of the dominant actor to coerce those who challenge its authority. By way of example, we can compare the requirements issued by a legitimate government to its people to the requirements issued by a band of kidnappers to a group of citizens. The requirements made by the government are supported by authority, insofar as most citizens recognize the government's right to make claims on them and to coerce them if they fail to make good on those claims. The requirements made by the gang of kidnappers will not be based on authority but on pure coercion, communicated through commands like "send us the money or we kill the hostage". Coercion and authority are related insofar as authority decreases the need for constant coercion, while coercion is needed to prevent authority from unraveling. In this way coercion becomes necessary to sustain authority while authority is unnecessary to engage in coercion (Lake 2009b, 21-23). In short, commands are authoritative when they are underpinned by a certain minimum of consent – even tacit consent - that de-necessitates the need for coercion, while they are coercive when they are exclusively underpinned by threat.

Following this understanding, if one actor, A, has authority over B their relationship is hierarchical. Lake has formulated this view clearly by defining hierarchy as "a variable defined by the authority of the ruler over an increasing number of issues otherwise reserved to the ruled" (Lake 2009b, 45).

Among scholars who subscribe to the view that hierarchy is a matter of political authority, there are different opinions about where authority originates, and, by implication, about how important it is in international politics. One group of scholars locate authority in formal-legal designations, and, more specifically, in the institution of national sovereignty. They represent what David Lake calls the "formal-legalistic" view of authority (Lake 2009b, 24). This formal-legalistic conception of authority can be traced to Max Weber, who defines formal-legal authority as authority resting on "a belief in the 'legality' of patterns of normative rules and the right of those elevated to authority under such rules to issue commands (legal authority)" (Weber 1947, 328). On this understanding, A`s ability to issue legitimate commands on B follows *exclusively* from the formal position that A holds in a given society, and it does not stem from any other of A`s characteristics (Lake 2009b, 24-25). As Lake has pointed out, since this view does not allow for hierarchical relationships where they are not supported by formal legal institutions of political authority, it follows that hierarchy is not an important phenomenon in international relations since there is no *formal* political authority that stands above the sovereign state (Lake 2009b, 24-28).

An example of this view can be found in *Neorealist* theory. Neorealist scholars put little explicit emphasis on a concept like formal-legal authority, but it must be noted that formal-legal here *only* means that neorealists locate authority in the formal designation of national sovereignty.[7] The most explicit formulation of this view can be found in Kenneth Waltz` classic; *Theory of International Politics* (1979). In Waltz` work, anarchy, in the sense of *formal equality between states*, is taken to be the "ordering principle" of the international political system, and Waltz assigns the same role to hierarchy in a domestic system (Waltz 1979, 81). [8] Since the units populating the system enjoy legal sovereignty and formal equality, and since there are no formal entitlements to neither command nor obey, the international system is characterized by what Waltz terms an "absence of government" (1979, 98). In this way hierarchy is defined out of Waltz` theory.[9] Other neorealist scholars (Mearsheimer 2001; Walt 1987) differ from Waltz in important ways, but they all consider anarchy to be the defining characteristic of international relations, and they downplay the role of hierarchical relationships. This lack of emphasis follows logically from the focus on the institution of sovereignty as the main source of political authority.

A second type of argument traces hierarchy to what I will here call *ideological* authority. The most coherent versions of this view have been articulated by scholars in the *constructivist* tradition of IR scholarship. Constructivists emphasize the role of ideas, norms, preference formation, and collective identities in international politics (For reviews see Checkel 2004; Dessler and Owen 2003; Finnemore and Sikkink 2001). While many constructivist scholars

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[7] This does not in any way imply that neorealism is a juristic theory of international politics. Indeed, neorealism downplays the importance of *all other formal legal structures than sovereignty.* On the face of it, this might seem like it makes neorealism inconsistent, but this is not the case. Since neorealism claims that sovereignty takes priority over all other formal-legal international arrangements, and since it claims that sovereignty implies the unenforceability of other international formal-legal arrangements, it follows logically that an emphasis on formal-legal sovereignty is consistent with claiming that international law is devoid of authority.

[8] It is important to realize that Waltz treats anarchy as a theoretical *assumption*, and on his instrumentalist view, its accuracy should be judged not by its approximation to reality, but by the success of the predictions that can be derived from it (Waltz 1979, 6-8). So even though Waltz clearly thinks that the condition of anarchy is broadly descriptive of international relations, the realism of this assumption plays a nonessential part in the framework. This view is commonly known as *instrumentalism*. In the social sciences, it was famously articulated by Milton Friedman (1953, 4), and the virtues and vices of instrumentalism have been debated (Waltz 1979, 6-8).

[9] Waltz does concede that "all societies are organized segmentally in greater or lesser degree" (Waltz 1979, 114-115), and he thereby opens the door to a more fine-grained categorization of political systems. He nevertheless claims that moving away from his dichotomization will "be to move away from a theory claiming explanatory power to a less theoretical system promising greater descriptive accuracy" (Waltz 1979, 115). He thus lands on the idea that a theory treating the international system as devoid of authority has more explanatory power than it`s opposite.

have focused on hierarchy,[10] Wendt and Friedheim`s contribution is the most representative (1995). They define international hierarchy as "de facto authority relationships that construct the identities and interests of their members" (Wendt and Friedheim 1995, 690). These are relationships in which dominant states "manufacture consent" or legitimacy in the subordinate state (Wendt and Friedheim 1995, 700). On this view hierarchy arises from an intersubjective normative structure which partly determines the preferences of its participants. Hierarchy is here considered as an important and widespread phenomenon in international politics, insofar as these inter-subjective normative structures persist.

The third view locates authority in a bargained equilibrium between partly rational actors – what Lake refers to as *relational authority* (Lake 2009a, 301; 2009b, 28-29) – and it underpins the transaction-cost theory of hierarchy that will be investigated in this thesis. Lake does not trace authority to formal-legal designations or to ideological structures, but to a social contract between ruler and ruled. He explains it as a type of authority that is:

> premised on the exchange between ruler and ruled in which A provides a political order of value to B sufficient to offset the loss of freedom incurred in his subordination to A, and B confers the right on A to exert restraints on his behavior necessary to provide that order (Lake 2009b, 28-29).

This view finds a precedent in Thomas Hobbes` model in *Leviathan,* where actors willingly give up part of their autonomy to an overarching authority in return for security (Hobbes [1651] (1962)). Following this view, authority relations do not necessarily rest on formal designations, nor on ideological hegemony, but on a bargained equilibrium, struck between rational (or partly rational) agents. The only conditions that need to be present for hierarchies to form are the incentive structures that will make such a bargain more beneficial than not. Authority will normally rest on the capacity of the dominant actor to coerce the subordinate, but authority decreases the need for constant coercion. Other proponents of this view are Weber (1997, 2000), Cooley (2005) and Cooley and Spruyt (2009).[11] The relational authority view of hierarchy enables the perspective of the transaction-cost theory, where the parties to an authority relationship are considered as rational, and the hierarchy that is established is considered as an equilibrium outcome of an incentive structure where transaction-costs play a

[10] Other notable contributions are Strang (1996), and Pagden (1995).
[11] Although Cooley (2005) and Cooley and Spruyt (2009) are more interested in explaining intra-hierarchy variation, they still share the idea of hierarchy as a rational bargain as a crucial premise. Like Lake (1999) and Weber (1997, 2000), they too try to explain variations in hierarchy with variables and hypotheses from the school of neo-institutional economics that TCE is a part of.

decisive role (this will be presented in detail in chapter 3).[12] Since it constitutes the conceptual foundation for the transaction-cost theory of hierarchy, it will be the underlying conceptual framework in the rest of this thesis. This choice is a pragmatic one. It is made because it enables us to focus on the relationships that will be studied in this thesis, and not because the relational conception exhausts the meaning of the concept of hierarchy.

Table 1 - Different understandings of hierarchy in IR

Hierarchy understood as…	Hierarchy is present when..	Hierarchy is important in international politics
Asymmetries in military or economic power	*there are obvious asymmetries in military or economic power*	*yes*
Political authority – formal	*it is supported by formal designations*	*no*
Political authority – ideological	*it is supported by ideological structures*	*yes*
Political authority – relational	*it is supported by a bargained equilibrium, struck between partly rational actors*	*yes*

To summarize, there are three views of the sources of international authority. One view locates international authority in the formal-legal institution of sovereignty and puts less emphasis on hierarchy as a salient feature of international relations since there is no formal-legal authority above the state. The second view locates authority in an ideological deep structure, and it emphasizes hierarchy as a salient feature of international relations insofar as this structure perseveres. The third view argues that authority can flow from an implicit or explicit social contract where the dominant party provides something of value to the subordinate in return for an increased degree of authority over it. This view leads to a study of international relationships where authority is bargained over, gained and lost. In this last view hierarchy is a pervasive and widespread phenomenon in international politics. As mentioned, this is the understanding of hierarchy that the transaction-cost argument rests on, and that I will view as the conceptual foundation of the arguments made in the thesis.

[12] This does not mean that the citizens of the subordinate necessarily accept the hierarchy, only that elites in the subordinate polity accept it, in the sense that they are not willing to resist in a significant degree.

2.2 The varieties of hierarchical organization

In this section I will present the continuum of security relationships as it is envisioned by the proponents of the transaction-cost theory (see figure 1). That the notion of such a spectrum makes theoretical sense is one of the key premises of the transaction-cost theory of hierarchical security cooperation. After that I will give a short presentation of the literature on military alliances, and I will argue that military alliances should be seen as one empirical domain within the broader context of hierarchical security cooperation.

2.2.1 The anarchy-hierarchy continuum

The transaction-cost theorists of hierarchy locate security relationships on a spectrum, varying from more to less hierarchically organized (Lake 1999, 5-7, 27; Weber 2000, 4-5). The extreme hierarchical end of this spectrum is an empire, where A commands B`s actions across a vast range of options in both the economic and the security domain, while the more anarchical end of the scale is where A cannot command any of B`s actions, and relations are conducted through the use of arms-length diplomacy (Lake 1999, 27-31).

Lake claims that dyadic hierarchy is a salient and widespread phenomenon in modern international politics. In a recent book (Lake 2009b), and in several articles (Lake 2007, 2009a, 2009d), he traces the empirical patterns of U.S. hierarchy in international relations. He shows how dyadic hierarchies have an important impact on phenomenon like the defense spending of subordinate states (Lake 2007, 74), the likelihood that subordinate states will join an international military coalition with the dominant state (Lake 2009b, 170-171), the likelihood that the dominant state will intervene in militarized interstate disputes or international crises (Lake 2009b, 108-110), and the trade openness and trade flows of subordinate states (Lake 2009b, 155,158-159).

Katja Weber (1997, 2000) has taken a similar approach to international hierarchy. Like Lake, she draws up a continuum of forms of security cooperation that “ranges from relationships characterized by high maneuverability or autonomy to highly structured relationships with significantly restricted maneuverability or autonomy” (Weber 1997, 322). In her scheme, alliances with equality between the partners lie at the anarchic end of the continuum while confederations can be found at the extreme hierarchical end (Weber 1997, 322-324; 2000, 4-5).

Figure 1 - The anarchy-hierarchy continuum

2.2.2 Military alliances as hierarchical relationships

I will here argue that different kinds of military alliances can be categorized by using the anarchy-hierarchy spectrum. A formal written military alliance is one of the most common forms of security cooperation in international relations. I will here follow Leeds et.al in defining alliances as

> written agreements, signed by official representatives of at least two independent states, that include promises to aid a partner in the event of military conflict, to remain neutral in the event of conflict, to refrain from military conflict with one another, or to consult/cooperate in the event of international crises that create a potential for military conflict (Leeds et al. 2002, 238).

Some alliances are egalitarian and include few provisions that can underpin a hierarchically integrated structure, while other alliances are highly integrated and asymmetrical, opening up for the domination of the stronger state. In alliances that are egalitarian, decision-making authority and residual rights of control remains with the individual parties, and neither party cedes authority to the other party or to a decision-making body above them. The alliance between France and Great Britain (later joined by Russia), signed prior to World War I, is an example of an alliance where the members lost very little of their decision-making authority. The only obligation in this alliance was that:

> if either Government had grave reason to expect an unprovoked attack by a third Power, or something that threatened the general peace, it should immediately discuss with the other whether both Governments should act together to prevent aggression and to preserve peace, and, if so, what measures they would be prepared to take in common. If these measures involved action, the plans of the General Staffs would at once be taken into consideration, and the

Governments would then decide what effect should be given to them. (British Foreign office, cited in the ATOP code sheet, alliance number 1485[13] (Leeds et al. 2000b)).

In alliances that are organized hierarchically the weaker state cedes part of its decision-making capacity to the dominant state, either explicitly or implicitly. The alliances between the United States and Taiwan,[14] South Korea,[15] and Japan[16] are examples of alliances where these weaker partners ceded a large degree of foreign-policy autonomy to their bigger and mightier partner. The alliances gave the United States the right to a major military presence on the soil of the subordinates, turning them into de facto military client states. In a recent comparative study of U.S. bilateral alliances in Asia, Cha notes that the United States "fashioned a series of deep, tight bilateral alliances with Taiwan, South Korea, and Japan to *control their ability to use force and to foster material and political dependency on the United States*" (Cha 2010, 168, my emphasis). A more ancient example is the alliance between Athens and its Hellenic neighbors, described in Thucydides` *The Peloponnesian War* (Thucydides 1998). This alliance, known as "the Delian League", is described by Thucydides as an instrument of Athenian domination, evolving from a more egalitarian alliance at the outset, into a tributory Athenian empire (Thucydides 1998, 46-51).

To make the relationship between alliances and the anarchy-hierarchy spectrum a little clearer we can imagine hierarchy as a continuous variable; H, with thresholds τ for each actualized form of hierarchical or non-hierarchical relationship, and hierarchical alliance design as a dichotomous variable where Y=1 represents hierarchical alliance design. To simplify further, we can imagine that there are four such thresholds; (1) an egalitarian relationship, (2) a hierarchical alliance, (3) a protectorate/confederation, and (4) an empire,

[13] The ATOP code sheet does not include page numbers, but the individual alliances are organized by alliance number. The code sheets for all the alliances can be downloaded from: http://atop.rice.edu/

[14] In the U.S. alliance with Taiwan, the agreement states that "(Taiwan) grants, and the (U.S..) accepts, the right to dispose such United States land, air and sea forces in and about Taiwan and the Pescadores as may be required for their defense, as determined by mutual agreement." (Alliance number 3530 in the ATOP code sheet (Leeds et.al 2000b)).

[15] In the U.S. alliance with South Korea, the agreement states that "The Republic of Korea grants, and the United States of America accepts, the right to dispose United States land, air and sea forces in and about the territory of the Republic of Korea as determined by mutual agreement." (Alliance number 3240 in the ATOP code sheet (Leeds et.al 2000b)).

[16] The U.S.-Japan alliance of 1950 curtails Japanese autonomy in several ways. Article II states that "During the exercise of the right referred to in Article I, Japan will not grant, without the prior consent of the United States of America, any bases or any rights, powers or authority whatsoever, in or relating to bases or the right of garrison or of maneuver, or transit of ground, air or naval forces to any third power.", and article I states that "Japan grants, and the United States of America accepts, the right, upon the coming into force of the Treaty of Peace and of this Treaty, to dispose United States land, air and sea forces in and about Japan." (Alliance number 3220 in the ATOP code sheet (Leeds et.al 2000b)).

with higher thresholds becoming increasingly likely at higher levels of H. Understood in this way, my dependent variable, hierarchical alliance design, is equal to 1 if $\tau 2 < H < \tau 3$, while it is equal to 0 if $H < \tau 2$ or $H > \tau 3$.

Much attention in the IR field has been devoted to the study of international alliances. Research has been done on why alliances are formed (Altfeld 1984; Gibler 2008; Gibler and Rider 2004; Gibler and Sarkees 2004; Gibler and Wolford 2006; Kimball 2006, 2010; Lai and Raiter 2000; Leeds et al. 2002; Morrow 1991; Simon and Gartzke 1996; Sweeney and Fritz 2004; Walt 1985, 1987), their effects on military strategy (Wallace 2008), their duration (Bennett 1997), their effect on conflict behavior (Gibler 2008; Kimball 2006; Leeds 2003b; Leeds and Mattes 2007; Mattes and Vonnahme 2010; Powers 2006), the reliability of alliance partners (Gartzke and Gleditsch 2004; Leeds 1999, 2003a; Leeds and Anac 2005; Leeds, Long, and Mitchell 2000a; Leeds, Mattes, and Vogel 2009; Leeds and Savun 2007; Powers 2006), and their effect on other forms of international cooperation (Fordham 2010; Long and Leeds 2006). In spite of this great wave of research, close to no attempts have been made at explaining the institutional design of military alliances. If Lake (1999, 2001) and Weber (1997, 2000) are right in arguing that alliances should be seen in relation to other forms of hierarchical security relationships, entailing that transaction-cost arguments should apply to alliance design, this lack of research is indeed puzzling.

2.3 Summary

Above, I have outlined the theoretical context of the topic of international security hierarchies. This review maps some general conceptual strategies for understanding the concept of hierarchy, and how these understandings relate to whether or not one will consider hierarchy to be an important phenomenon in international politics. I have argued that two understandings dominate: An understanding of hierarchy as asymmetries in power, and an understanding of hierarchy as relationships of authority. In the latter category authority is located either in formal designations, ideological structures, or in relational bargains. I have argued that the approach outlined by Lake (2009a, 2009b, 2009c) that conceptualizes hierarchy as a relationship where one actor has political authority over another, and that locates the source of this authority in a bargain between dominant and subordinate actor, is the most useful approach if one is going to study hierarchical relationships from a transaction-cost perspective. The transaction-cost theory will be the subject of the next chapter.

3. Theory

– Any issue that can be formulated as a contracting problem can be investigated to advantage in transaction-cost economizing terms. – Oliver Williamson, 1985[17]

–Shall I join with other nations in alliance?
If allies are weak, am I not best alone?
If allies are strong with power to protect me,
Might they not protect me out of all I own? – The King of Siam, in Richard Rodgers and Oscar Hammerstein`s "*The King and I",* 1951[18]

Having established the theoretical context of the topic of hierarchy and its relevance to research on international alliances, I will now present the transaction-cost approach theory of international security in general, and how it applies to the domain of alliance design in particular. The transaction-cost theory of international hierarchies purports to explain variations along the anarchy-hierarchy continuum of security relationships. It is an application of the central ideas of transaction-cost economics (TCE from now on) to political science.

To understand the transaction-cost theory of hierarchical security relationships, it is important to understand its origins and formulation in economics, where the logic of the transaction-cost argument originated. I will therefore start this chapter by briefly presenting the transaction-cost theory as it has been formulated in economics. After that, I will go on to present its application to hierarchical security relationships in general, and then I will derive a more specific application to the question of alliance design.

3.1 The transaction-cost theory of firms

The TCE branch of economics can be traced to Ronald Coase who – in a classic article - addressed the problem of why some economic transactions are coordinated by price mechanisms in markets, while other transactions are internalized in firms. In Coase`s words; "in place of the complicated market structure with exchange transactions is substituted the entrepreneur-co-coordinator who directs production" (Coase 1937, 388). By studying this question, Coase treated the units and structures economists took as givens – firms and markets – as dependent variables, and he saw the choice of economic governance structure as something in need of explanation.

[17] Williamson (1985, 17)
[18] Hammerstein and Rodgers (1951), cited in Barnett and Levy (1991, 375).

Coase`s central insight was that some economic transactions are more beneficial in non-market settings, within firms, where the authority and direction of the bosses replaces price-signals as a "co-coordinating instrument" (Coase 1937, 389). The Coasian answer to the question posed above was that hierarchical economic structures (firms) are chosen when designing specific contracts to govern transactions is harder and costlier than integrating supplier buyer relations in one single economic structure, or one "long-term contract" (Pitelis 1993, 8). Oliver Williamson (1973, 1975, 1979, 1981, 1985) has later come up with behavioral assumptions that can underpin the Coasian perspective, and he has proposed a more explicit set of independent variables to explain variations along the firm-market continuum. Willamson`s work is considered to be the standard formulation of TCE theory.

The organizing principle in TCE is that the way transactions are organized depends on how easy it is to write the costs originating from the transaction itself – the transaction-costs - into a contract. If these costs can be specified and written into a contract, and if this contract can be enforced, then all that is needed for a transaction to take place is one single written contract. If costs are hard to specify, and contracts are not likely to be followed, then one needs more than a contract to realize the transaction. One needs a specialized governance structure with built-in safeguards that incentivize the actors to follow the rules (Williamson 1985, 20).

3.1.1 Assumptions

TCE theory rests on several core assumptions about economic actors.[19] First, it assumes *bounded rationality*, meaning that economic actors are "intendedly rational, but only limitedly so" (Simon 1961, in Willamson 1985, 45). Williamson understands bounded rationality as constraints on information processing arising from the fact that "cognitive competence is limited" (1985, 45).[20] Economic actors are simply not capable of contemplating every possible development and their associated probabilities in advance (Williamson 1985, 57, 59).

The second behavioral assumption that is postulated by TCE is *opportunism.* This is defined by Williamson as "self-interest seeking with guile" meaning that actors will engage in "calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse" (1985, 47).

[19]It is important to note that assumptions in TCE not only are evaluated by criteria that mirror Friedman (1953, 4) and Waltz`s (1979, 6-8) exclusive emphasis on theoretical usefulness, but also by their approximation to reality. The behavioral assumptions are patterned on "human nature as we know it" (Williamson 1985, 44).

[20] If we accept Elster`s (2007, 191) requirements for an action to be considered as rational - that it must "be optimal, given the beliefs; the beliefs must be as well supported as possible, given the evidence; and the evidence must result from an optimal investment in information gathering." - then the limits on rationality that Williamson assumes can be linked to information gathering (1985, 45-46,50-52,56-59).

Opportunism compounds the effects of bounded rationality. As Williamson notes, "were it not for opportunism, all behavior could be rule governed", since actors could simply agree not to cheat or break promises if unanticipated developments were to occur (1985, 48).[21]

The combination of the two behavioral assumptions mentioned is a necessary condition for TCE. If actors were boundedly rational, but not disposed to behave opportunistically, they could write a "general clause device" into the contract, in which they agreed to abide by promises to behave "in a joint profit maximizing way" if unexpected contingencies were to occur (Williamson 1985, 50-51). Furthermore, if actors were unboundedly rational, and disposed to behave opportunistically, they could contemplate all ex post contingencies in advance and write them into a contract at the outset (Williamson 1985, 50-51, 81). Given that bounded rationality and opportunism are realistic assumptions about economic actors, problems of contracting will arise in connection with specific types of transactions. According to Williamson the main transaction characteristics that determine how a transaction will be organized are *asset specificity*, *behavioral and non-behavioral uncertainty*, and *frequency* (1985, 52). These variables will be presented below.

3.1.2 Dependent variable: Governance structure

The dependent variable in TCE is the choice of governance structure to regulate a transaction. Governance structures fall along a continuum where they vary in their degree of hierarchical integration. A market is the least hierarchically integrated form of governance structure, and it suffices when there are no transaction-specific assets and each producer and consumer can turn elsewhere with their business as dictated by supply and demand, with "little transitional expense" (Williamson 1985, 74). The mechanism that regulates a free market is the flow and distribution of individual economic incentives. At the other end of the spectrum we find unified governance within one organization. Such a governance structure allows the actors to adapt "in a sequential way without the need to consult, complete, or revise interfirm agreements" (Williamson 1985, 78) . In a unified governance structure the regulatory mechanism is directives from higher levels of authority.

3.1.3 Independent variables

Given the assumptions mentioned above, four variables are assumed to push in the direction

[21] The assumption of opportunistic behavior does not need to hold true for all actors all of the time for the theory to work. Contracting problems will arise if opportunism is present in a population to a sufficient degree (Williamson 1985, 48,58).

of unified governance: Non-behavioral and behavioral uncertainty, frequency, and asset specificity.

Asset specificity – or relational specificity - is an important variable in TCE, and Williamson describes it as "the big locomotive to which transaction cost economics owes much of its predictive content" (Williamson 1985, 56). It is a condition defined as

> durable investments that are undertaken in support of particular transactions, the opportunity cost of which investments is much lower in best alternative uses or by alternative users should the original transaction be prematurely terminated (Williamson 1985, 55).

If such an investment is made "the *specific identity of the parties to a transaction plainly matters*" (Williamson 1985, 55, my emphasis). When asset-specificity is high, pure arms-length market transactions will be inadequate since the potential for opportunism and exogenous shocks will offset the potential benefits that can be realized in the transaction. In other words, an asset specific investment will never be made in a market when there is a high probability of opportunism, and opportunism cannot be guarded against by contracting or through other mechanisms short of hierarchy.

Relationally specific investments can arise through site specificity, physical specificity, human specificity, or through what Williamson calls "dedicated assets" (1985, 55). I will here illustrate these forms of specificity by relating them to an example where the Heineken beer company is conducting a transaction with a manufacturer of beer bottles.

Site specificity is exemplified when "successive stations…… are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses" (Williamson 1981, 555). In the Heineken case, *site specificity* would arise if the maker of bottles were located close to the Heineken brewery in Amsterdam, implying a low cost of transporting bottles to the brewery (or beer to the bottle plant). *Physical specificity* is exemplified when a company buys equipment that is specialized to produce a certain component that is specific to the buyer of the goods. In the Heineken case this would occur if the bottle maker had to buy equipment *exclusively* designed to make Heineken beer bottles. *Human specificity* is exemplified when an employee learns a skill that only can be used in a particular relationship. In the Heineken case this would arise if the bottle maker had to train personnel specifically to make Heineken bottles, and the skills acquired by this training could not be converted to skills at making bottles for other companies. *Dedicated assets* are present when a company invests in a general production capacity that will only be beneficial given the continuation of a certain relationship with the other party (Williamson 1985, 95). In the

Heineken case this would arise if the factory made an investment in an increased production capacity for beer bottles (as opposed to other bottles), and this increase would not be beneficial if Heineken chose to buy bottles from someone else.

Asset specificity heightens the costs of leaving a relationship. In the Heineken case it would heighten the costs for the bottle maker of choosing to make bottles for another brewer, and it would generate incentives for Heineken to ask for a lower buying price after the deal had been made, as the cost of leaving Heineken for another company now would be much higher for the bottle maker. If the bottle maker foresees this development, it would make it very hard to realize the transaction in the first place, since the diffuse costs and benefits of the relationship – generated by asset specificity - are hard to write into an explicit contract. In short, as the practical value of an asset becomes more and more exclusive to one particular relationship, the value of this relationship to the provider of this asset grows, giving the provider incentives to keep the buyer from defecting or exploiting her. In such cases it will be rational to replace market relations with unified ownership that will make it possible to internalize these costs and benefits (Williamson 1985, 53, 78).[22] This could be done if Heineken bought the bottle producer or merged with it (if it was big enough).

Uncertainty is another important variable in the framework. This variable comes in two categories, as Williamson distinguishes between behavioral and non-behavioral uncertainty. *Behavioral uncertainty* is inherent in the condition of opportunism, but it is not a constant, as dispositions to behave opportunistically will vary in intensity across actors. *Non-behavioral* uncertainty is also an important factor. Such uncertainty can arise from exogenous disturbances that require new and unexpected adaptations which will jeopardize benefits, and especially when there is relational specificity. Behavioral uncertainty (opportunism), and non-behavioral uncertainty, and asset specificity combine to increase the probability that a transaction will be internalized (Williamson 1985, 58-60, 79).

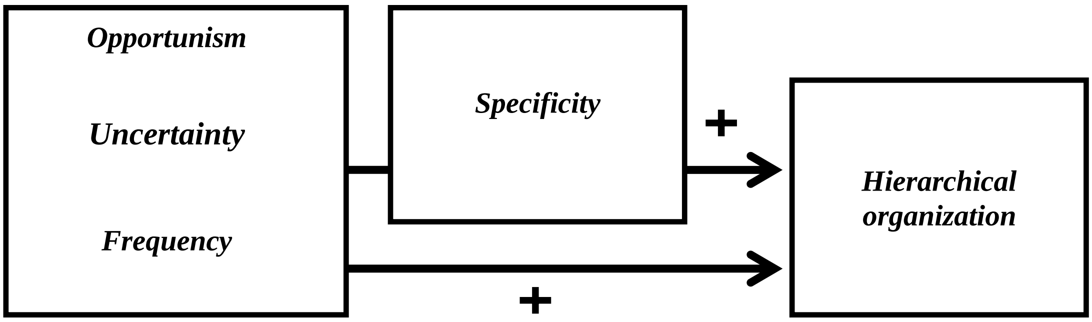
The *frequency* with which a transaction occurs is another important variable in the framework. The benefits of a specialized governance structure increase with the degree to which a transaction is "of a recurring kind" (Williamson 1985, 60). A high frequency of interaction will "permit the cost of the specialized governance structure to be recovered"

[22] This does not mean that this would produce a fair outcome, but it would be an efficient outcome, as the alternative would probably be that the transaction would never be realized.

(Williamson 1979, 250), the notion here is that the short term “set up cost” of the governance structure will be much easier to justify if long term interaction is expected (Williamson 1979, 246). If a transaction is nonspecific and frequent it can take place in a market, because customers and sellers can automatically turn elsewhere with their preferences since the products are standardized and do not depend on a specific buyer-seller relation. If it is specific and infrequent it will give rise to more intermediate forms of relationships, while specificity and frequency combined will produce powerful drives towards hierarchical integration (Williamson 1985, 74-79).

To sum up, the TCE theory, as it is formulated by Oliver Williamson, states that a transaction between boundedly rational and opportunistic actors under conditions of high uncertainty and frequency, that requires asset-specific investments is likely to occur within a unified and hierarchically organized economic governance structure. Such a structure is assumed to be profit maximizing for the actors, as it will keep *identity* constant while adjustments for price and quantity can be made internally (Williamson 1985, 78). A unified causal model of the transaction-cost theory can be found below, in figure 2. This modeled will be filled out with more specific variables as the thesis proceeds.

Figure 2 - A transaction-cost model of economic governance



Despite being plagued by problems of operationalization, many studies in economics has found support for Williamson`s theory (For surveys of the empirical literature see Shelanski and Klein (1995), Crocker and Masten (1995), and Masten and Saussier (2000)).[23]

[23] Many of the empirical studies testing the theory of TCE are quantitative or qualitative case studies of one industry in particular (Shelanski and Klein 1995; Crocker and Masten 1996). This may have something to do with the difficulty of finding valid measures for the independent variables that can travel across many different contexts (Shelanski and Klein 1995, 339). Problems with finding valid measurements of the independent

3.2 The transaction-cost theory of international security hierarchies

The TCE approach has found uses in political science as well. It has been used to explain the degree to which international foreign investments were accompanied by colonial military control from source countries (Frieden 1994), the delegation of power from majoritarian to non-majoritarian political institutions (Majone 2001), and the "demand for international regimes" in different areas of international governance (Keohane 1982). Crucially for our purposes, it has been applied to the domain of international security and cooperation (Cooley 2005; Cooley and Spruyt 2009; Haftendorn, Keohane, and Wallander 1999; Koremenos 2005; Koremenos, Lipson, and Snidal 2001; Lake 1996, 1999, 2001; Leeds 2000; Weber 1997, 2000). It has been most explicitly used to study hierarchical contracting in dyadic relationships by Lake (Lake 1996, 1999, 2001), Weber (1997, 2000), and by Leeds (2000). I will therefore primarily draw on these authors in presenting the argument.

Its application in this field rests on the analogy between non-hierarchical security relations between states (IR) and market relations (economics) on the one hand, and the analogy between hierarchical dominance relations between polities (IR) and firms (economics) on the other. The main idea that characterizes the transaction-cost approach in IR is that, as Weber notes, "international relations resembles the world of firms in that the provision of security can require replacing anarchy (market) with hierarchical governance structures (firm)" (Weber 1997, 329). It is important to keep in mind that the logic of the TCE argument may actually be *more relevant* in IR, since there are usually fewer external third-party mechanisms to enforce contracts and guarantee stability in the international system than there are in economic markets.

After presenting the theory as it applies to security in general, I will link it more specifically to the study of alliances. This will prepare the ground for testing a transaction-cost theory of hierarchical security cooperation.

3.2.1 Assumptions

Assumptions are important, and should always be made explicit. I will therefore go through the assumptions of the theory here. The assumptions that underpin the transaction-cost approach to international security are in many ways similar to the assumptions in Williamson`s theory, but they are tailored to apply to international relations. They are most

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variables – uncertainty, frequency, asset specificity - plague TCE more generally (Shelanski and Klein 1995, 340).

explicitly presented and developed in Lake (1999, 39-44) so his discussion will form much of the foundation for this section.

The first assumption concerns the actors in the theory. Lake emphasizes that the *polity* is the relevant unit of analysis (1999, 18).[24] And it is clear from Weber (2000, 5) that she also focuses on polities, and not exclusively on states. Lake`s objection to using states as the unit of analysis is that a narrow focus on states would exclude territorially organized political communities that are not states,[25] like colonies and protectorates, and that this would contaminate the analysis with damaging forms of bias, since being under colonial rule or in a protectorate are clear instances of hierarchical subordination and thus *values on the dependent variable*.[26] For the application of the transaction cost theory to the specific domain in my empirical test, on alliances from 1815 to 2003, this does not make much of a difference since all these alliances are between recognized sovereign states.

Second, it is assumed that polities are *unitary actors* that are “rational and forward looking” (Lake 1999, 39-40), in the sense that they have “transitive preferences and act purposively to achieve their goal”, and that they “anticipate the reactions of others to their actions and base their own choices upon these expectations” (Lake 1999, 40). Like the assumption about economic actors in TCE it is assumed that polities are boundedly rational, making them incapable of planning for all possible contingencies in advance (Lake 1999, 41).

A third assumption is that the polity is analogous to a firm that produces security (Lake 1999, 5, 24; Weber 2000, 9-10, 16-17). Security is defined by Lake as the degree to which a polity is at risk of “intentional violence employed by others”, and the degree to which it can “accumulate and allocate wealth free from external coercion” (Lake 1999, 21). Security is here viewed as a good that a polity can enjoy greater or lesser amounts of, in the same way as

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[24] A polity is defined by Lake as “*any* organized *political community* that has or *could have* a history of self-rule”, and, furthermore, that “at any moment in time, however, the universe of polities is defined by those organized political communities that *could, at least in the abstract,* survive as independent actors in world politics.”(my emphasis) (Lake 1999, 18). Lake`s definition is arguably too vague to bear the analytical weight it is intended to carry. It can be argued that a political community that “has or *could have* a history of self-rule”, and that “could, at least in the abstract, survive as independent actors in world politics.” (Lake 1999, 18), includes actors that one would reject calling polities. Al Qaeda and the Communist international all fit Lake`s criterion but it is arguably counterintuitive to call them polities. The definition would be improved if we included a supplementary criterion requiring that we only refer to territorially organized political communities. This would make the definition more robust to such criticism. It is clear from Weber (2000, 5) that she also means territorially organized political communities when she is applying her theory.

[25] This differs from most varieties of security-oriented IR scholarship, which treats the *state* as the unit of analysis (Jackson and Sorensen 2010, 58-95).

[26] For some values on our dependent variable, like alliances, this will not be a problem since only states are capable of joining international military alliances.

it can enjoy greater or lesser amounts of wealth. This means that security can be pooled, generated unilaterally, or undersupplied. If polity A is threatened by polity B, it can choose to pool security with polity C, and perhaps accept the domination of polity C. It will be more secure in a hierarchy with polity C than it will be unilaterally as long as polity C will coerce it *less* than polity B would have done (Lake 1999, 24-29).

It is also assumed that security constitutes a single policy dimension and that domestic politics in polity A plays a negligible role in its selection of security relationship with polity B (Lake 1999, 40). This does not mean that domestic conditions in polity B do not influence A`s choice of security relationship.

A fifth assumption is that polities do not have preferences for *particular* security relationships beyond how they contribute to producing security. In short, there are no intrinsic characteristics of a security relationship that make it more attractive than another. The value of a security relationship is only gauged by its relative value when compared to other counterfactual security strategies (Lake 1999, 40-41).

A sixth assumption is that external threat should be treated as the “demand” for security cooperation. Both Lake and Weber share this view, but they differ on whether or not threat should be treated as a variable or as an assumption in the theory. In Lake`s framework security threats from other countries are treated as exogenous, as Lake assumes the “existence of a third party, and seeks to explain how the members of a dyad choose a particular response” (Lake 1999, 43).[27] Weber (1997, 2000) has chosen to include threat as a separate variable in her empirical analysis, but she does not consider it a variable that is exclusive to the transaction-cost model. If the inclusion of threat-level is a significant explanatory factor in my analysis, we should conclude that this assumption is unwarranted.

A seventh assumption is that political authority is divisible (Lake 1996, 6-9). This means that a polity can be sovereign in one domain of policy while being under the authority of an external polity in another. In a security hierarchy, for example, the dominant state can exert control over the subordinate state`s foreign policy, but not its internal non-defense related policies (Lake 2007, 56-60).

Assumptions are also made about the relevant lens through which to view the interaction of the polities in the relationship. Where Lake (1999) emphasizes the interaction between a powerful and a weaker state, and focuses on hierarchical governance where a dominant state

[27] This assumption is practical in that it enables an exclusive focus on dyads, but it has its problems. Among other things, it will make it harder to explain variation across time and space, as some external threats will vary across time and space, and this will influence the cost of unilateral security production.

has authority over a subordinate, Weber (2000) does not emphasize the power asymmetry between actors, and she focuses more on forms of hierarchical governance where all parties cede equal amounts of sovereignty to an integrated structure, like a confederation or a formalized security community. This difference is not crucial to the validity of the transaction-cost argument, since it is not important whether an actor cedes authority to the more powerful actor, akin to one firm buying up another smaller firm, or whether both firms integrate as equal partners, akin to a corporate merger. The independent variables will push towards vertical integration in either case. In the forthcoming analysis however, I will follow Lake`s (1999) approach and structure my analysis around the assumption that the interaction taking place is between a stronger and a weaker party, and assume that the utility calculus that matters is that of the stronger party. In this way, I will be testing Lake (1999) more than Weber (1997, 2000) and Leeds (2000). However, it should be noted that my dependent variable – hierarchical organization – in many ways measures both forms of integration, and that most of my variables are relevant to both the arguments of Lake (1999) and of Weber (2000).

Finally, the transaction cost theory of hierarchy assumes dyadic interaction, and it relies on a relational conception of authority relations, as presented in chapter 2, in that it assumes that a system which is formally anarchical can contain hierarchical relationships that should be viewed as equilibriums arrived at by strategic actors that are boundedly rational.

3.2.2 Dependent variable: A continuum of security relationships

The dependent variable in the transaction-cost theory of hierarchies is the form of security relationship chosen by a pair of states, and, more specifically, the degree to which this relationship is hierarchical or egalitarian (Weber 1997,2000; Lake 1999, 1996). This variable then, is the anarchy-hierarchy continuum of relational forms outlined above. On the non-hierarchical end of the scale, we find unilateralism, and egalitarian alliances, with no safeguards or rights of residual control. These can be viewed as analogous to free market contracts in the TCE theory of firms and markets. In the middle of the scale and moving towards more hierarchical forms, we find intermediate security architectures like hierarchical alliance structures with a mix of formal asymmetries, and/or obvious informal hierarchical characteristics. At the more extreme hierarchical end of the scale, we find formal protectorates, colonies, confederations, and empires. These are analogous to fully integrated firms. All of these categories have clear empirical referents, but this is not to say that they exhaust the spectrum of possible relational forms. The underlying dimension that we assume these forms to be tapping into is a continuous dimension of variations in authority, and in between these more or less crisp categories lie a range of hybrids that are much harder to identify (Lake 1999, 24-31). The degree of hierarchy in a relationship is defined as varying with the degree to which one of the actors in the relationship has political authority over the other (Lake 2007, 50; Weber 1997, 322).

3.2.3 Independent variables

I will here present how the independent variables in the transaction-cost theory apply to international security hierarchies. The variables that are central to the theory are the joint production economies of cooperation, opportunism, non-behavioral uncertainty, relational specificity,[28] frequency and governance costs.

The benefits of security cooperation are largely defined as the joint production economies that can be realized from such cooperation (Lake 1999, 44; Weber 1997, 326-327; 2000, 9-10). The presence of a threat, and the presence of joint production economies are seen as the demand for security cooperation. Joint production economies can arise in three ways. First, they can arise when economies of scale are possible. In security terms, this simply means that polity A can protect polity B more cheaply than polity B can do on its own, or that A and B can generate more security together at a cheaper price than they can unilaterally (Lake 1999, 44; Weber 1997, 326; 2000, 9-10). Secondly, joint production economies can arise if states have comparative advantages in different kinds of security-generating activities, and they can gain more security together by a division of labor (Lake 1999, 47-48; Weber 2000, 10). Thirdly, joint production economies can arise when positive externalities flow from particular kinds of security-generating activities. If one country is a "frontline state", facing an aggressive expansionist neighbor, its defense efforts will help the countries that lie behind it by serving as a buffer between them and the aggressive expansionist (Lake 1999, 49-50). Efforts to internalize such externalities will increase the likelihood of security cooperation.

Although Weber claims that cooperation becomes necessary when "the scale required to generate the capability to assure survival….exceeds any one state" (Weber 2000, 10), and although Lake (1999, 46-52) defines the benefits of cooperation mostly in terms of defense-related benefits for both states, the argument about joint production economies does not mean

[28] In describing and applying the security version of the theory I will consistently use the term relational specificity instead of asset specificity. The reason for this is that I believe the connotations of the word "asset" are too associative of economic investments, and this might be misleading. The key idea behind the asset-/relational-specificity variable is that it is a condition which makes the value of the transaction contingent on the specific relationships to the other party. That logic is better captured by the term relational specificity.

that *both* parties need to benefit from cooperation in security terms. The stronger party may not need the security guarantees of the smaller state or its capacity to deter an adversary. As Morrow (1991) has pointed out, states value both autonomy and security, and moderate levels of both autonomy and security is more valuable than having a high level of one and a low level of the other. Strong states will therefore often ally with weaker states to increase their autonomy, by gaining policy concessions, and political support.[29] In many cooperative relationships autonomy benefits will offset the difference between the greater security-need of the weaker state, and the lesser security-need of the stronger. Although not explicitly stated by Weber or Lake, I believe the "autonomy-security trade-off model" proposed by Morrow (1991) is the underlying premise of the argument about joint production economies. This means that the presence of joint production economies will result in security cooperation, since the security "producer" will be compensated with concessions by the weak state that lead to greater autonomy (Morrow 1991, 913). In other words, joint production economies alone are not enough for a hierarchy to be established, but they are a *necessary* condition for security cooperation, and we expect to see security cooperation in one form or another where joint production economies are present.

As in TCE, *relational specificity* plays an important role in the transaction-cost theory of security hierarchies (Weber 2000, 23-24; Lake 1999, 53-54; Leeds 2000, 54). It is present when a state has to make investments that are premised on the continued relationship with the other party, or when there are specific strategic conditions that make the other party particularly important to its security. Relational specificity can arise in several ways, and I will here only present some notable examples. First, it can be entailed by long-term military divisions of labor that are specific to the particular relationship at hand (Lake 1999, 54). One ally may have a comparative advantage at sea, while the other may have an advantage when it comes to land power. These states would be best off if they divided their defense capabilities to capitalize on these advantages, and such a division of labor would be specific to this particular relationship. Second, it can be entailed by "large investments in dedicated infrastructure or hardware" (Lake 1999, 54), such as strategically located ports or railways, specially designed military equipment, training and technology that have greater value in a specific security relationship with a specific state than in others (Lake 1999, 54;Weber 2000, 23-24). Third, as emphasized by Weber (2000), geographical factors may also give rise to

[29] More generally, autonomy is defined as the degree to which a state "pursues desired changes in the status quo" (Morrow 1991, 909).

relational specificity. If an ally is a neighboring state, or if it is strategically located, this will make its partner particularly vulnerable to opportunistic behavior (Weber 2000, 23-24).

Relational specificity sensitizes the cooperating parties (polities/states) to high costs of opportunistic behavior and non-behavioral uncertainty and it makes a structure that can economize on the diffuse benefits entailed by high frequency of interaction a more attractive option. Opportunistic behavior or sudden changes due to exogenous disturbances become a great problem for a security relationship when there are specific assets, since specific assets increase the costs for one party if the other party cheats or defects from the cooperative arrangement (Weber 2000, 24; Lake 1999, 53-55). Even though specific assets can be operationalized in their own right, it can be argued that *the very act* of allying by itself entails a relationally specific investment. The logic here is that the act of allying with another party can be, as Morrow (2000) has pointed out, a strong signal of continuity intentions, which are rendered less credible as signals if alliances are constantly violated. Furthermore, an alliance will in most cases require strategic, operational, and policy-related adjustments that are premised on the continuation of that alliance. This is a more diffuse form of relational specificity.

Behavioral and non-behavioral uncertainty are particularly salient features of international relations since there is no global government to enforce contracts and guarantee stability, and they are important variables in the transaction-cost theory of hierarchy.

Behavioral uncertainty follows from the assumption of opportunism. In the transaction-cost theory of security hierarchy, dispositions to opportunistic behavior are assumed to vary across actors, but generally polities are assumed to “press for individual advantage whenever possible” (Lake 1999, 52). States (or polities) are assumed to be generally suspicious of partners, as they fear that their partners “seek to cheat on their defense contributions or defect from the security arrangement” (Weber 2000, 21-22). Three forms of opportunistic behavior are emphasized. First, states can *defect* from the agreement, by refusing to follow up on commitments made. This can take the form of premature termination of the relationship, or of not making good on one`s commitment of coming to the aid of the partner when the partner is attacked (Weber 2000, 21; Lake 1999, 53; Leeds 2000, 51-54). Secondly, states can *entrap* their partners by pulling them into armed conflicts with other states that the partners have no incentives to participate in (Lake 1999, 53). The probability of such behavior can actually be increased by the assurances contained in the security guarantees that have been issued by their partners (Lake 1999, 53). This is similar to what is called “moral hazard” in economics. The logic implied here is that risk taking is encouraged by outside insurance that makes adverse risk taking outcomes less costly for the risk taking party because that cost is now shared with outside actors (Pauly 1968).This can be exemplified by South Korea, whose leaders, upon getting security guarantees from the United States, became more determined to start a conflict with their northern neighbor. A problem which led the United States to construct a tighter, more hierarchical relationship (Cha 2010, 173-178). Finally, states can *cheat,* or exploit, their partners, by seeking to alter the terms of the agreement after it has been made (Lake 1999, 53), or by general shirking on contributions and effort (Lake 1999, 53). Free riding on the defense-contributions of the partner is one example of such cheating behavior.

Non-behavioral uncertainty is referred to as "uncertainty….of a nonstrategic kind that arises due to lack of communication" (Weber 2000, 21). The greater the uncertainty, the greater the likelihood of unexpected shocks, the costs of which grow with relational specificity. Non-behavioral uncertainty combines with the assumption of opportunism in that uncertainty about the motives, capabilities and interests of the partner and of other important actors in the international environment makes it hard to write specific clauses relating to possible contingencies into the contract. Non-behavioral uncertainty is assumed to increase the likelihood of hierarchy in a relationship, since hierarchy increases the capacity of the relationship to absorb unexpected costs and adapt as circumstances change (Weber 2000, 21-22).

Frequency is not emphasized as an independent variable by Weber or by Lake, but I will argue that it should hold a central place in a transaction-cost theory of security cooperation as it does in TCE. How long the cooperating parties will interact will determine the magnitude of the benefits that can be realized by cooperation and the relative set-up cost of the hierarchical arrangement. When long-term interaction is characteristic of a relationship, cost-benefit allocations become hard to specify, while "efficiency…..requires that adaptations to changing market circumstances be made", opening up a space for opportunistic behavior, and making it hard to distribute costs and benefits efficiently (Williamson 1979, 241). In short, since long-term cooperation between boundedly rational actors cannot be governed by an exhaustive contract, a hierarchical governance structure that allows for sequential adaptation is more efficient. Weber hints at this when she mentions how the expectation of long-term cooperation against the threat from Napoleonic France influenced the reasoning of the parties to the Quadruple alliance (Weber 2000, 45). I will emphasize frequency as an equally important component of the transaction-cost model, and include it in my empirical tests.

Governance costs are defined by Lake as the "costs of making agreements, monitoring partners, and enforcing agreements" (Lake 1999, 59), and he operationalizes these costs as "lost autonomy and distorted incentives in the subordinate partner, safeguards on the dominant polity, and coercion" (Lake 1999, 59). In short they are the costs of maintaining a governance structure. If opportunism, frequency, specificity, and non-behavioral uncertainty can be seen metaphorically as the *gas pedals* of hierarchy in relationships where cooperation is beneficial, then governance costs can be imagined as the *break* on hierarchy.

Loss of autonomy and distorted incentives in the subordinate partner are governance costs because they require the dominant polity to compensate the subordinate, and/or to commit additional resources to oversight and management of the subordinate partner. The logic is as follows: If a hierarchical relationship means a loss of autonomy for the subordinate polity, the subordinate polity will have incentives to counter this loss of autonomy whenever possible. In many cases, the dominant polity will have to compensate the subordinate polity to make up for its loss of autonomy (Lake 1999, 59-61). Because subordinate polities will have greater and greater incentives to misrepresent information, and not follow up on commitments where there is no monitoring, since their activities to a greater and greater degree are directed by the dominant polity, the dominant polity has to commit more and more resources to monitoring and enforcement (Lake 1999, 60). If the dominant polity is not willing to compensate the subordinate, and monitoring and enforcement efforts are ineffective, then it must resort to coercion, which is also costly (Lake 1999, 61, 64-65). In short, the dominant polity has to coerce, compensate, or monitor the subordinate polity to keep it in its place as a subordinate. In addition to coercion and compensation, the dominant partner must show costly and credible signs of self-restraint, to ensure the subordinate partner that it will not be taken advantage of. As Lake notes, the deployment of troops in ""tripwire" positions to assuage allied fears of abandonment" (Lake 1999, 63) during the Cold War was one way for the U.S. to send such signals of continuity intentions. Another way is to engage in costly self-binding domestically, like making public pledges of support to the ally.

To sum up, a dominant polity will incur governance costs, either by having to engage in costly self-binding measures, or by having to compensate, monitor, or coerce a subordinate. Governance costs all rise with hierarchy.

3.2.4 Why hierarchical organization?

A key claim of the theory is that hierarchical organization will change the incentives and possibilities for opportunistic behavior, that it will make it easier to adjust to exogenous shocks caused by non-behavioral uncertainty, and that it will make it easier to distribute shifting and diffuse costs and benefits internally. A hierarchical structure entails a tighter relationship, where the room for private information and independent agency for the subordinate partner becomes limited (Lake 1999, 9). A hierarchical structure makes it easier to enforce, punish, and monitor subordinates, altering the incentives for opportunistic behavior. In addition to this, a hierarchical structure makes it easier to distribute costs and benefits internally as circumstances change and when costs and benefits are diffuse and hard to specify (Weber 2000, 13-29, Lake 1999, 44-73; Leeds 2000, 49-55). These are the functions normally performed by the state in the domestic realm. It follows from this that the higher the expected costs of opportunism and exogenous shocks entailed by security cooperation between two parties, and the harder it becomes to specify costs and benefits in a contract, the greater the likelihood of a hierarchical relationship (Lake 1999, 54-55; Weber 1997, 325).

An example of this logic at work can be found in the US-South Korean relationship in the early post-war period. The U.S. and South Korea were allies, and South Korea was considered an important state in the strategy of containment in Asia (Cha 2010). The fiery South Korean leader Syngman Rhee was bent on unification with the north, and sought every opportunity to stir a conflict with North Korea and China, in the firm conviction that he would get U.S. backing in the event of such a conflict (Cha 2010, 174). The United States feared that it would be pulled into an unwanted conflict by Rhee, and it needed to restrain him to prevent the collapse of the Korean state and a wider conflict in the region. To do this, the United States created a hierarchical defense treaty where the United States retained operational command authority over all South Korean military forces, which implied a continuation of U.S. command beyond the Korean War (Cha 2010, 176). As Cha notes, "the rationale for this extraordinary usurpation of state sovereignty was not only to facilitate combined war-fighting capabilities, but also to *restrain South Korea from undertaking aggressive unilateral actions against the North*" (2010, 176, my emphasis). In other words, a key reason for creating a hierarchical military alliance that curtailed South Korea`s autonomy was to guard against opportunistic behavior.

3.2.5 Previous empirical tests of the theory

The empirical tests of the transaction-cost theory have primarily been qualitative case studies, by Lake (1996, 1999, 2001), and Weber (1997, 2000). To my knowledge no attempt has been made to test the propositions of the TCE theory of hierarchies quantitatively.

Lake tests his theory through a number of qualitative case studies (1996, 1999, 2001), the most thorough of which is his book-length study of U.S. security relations in the 20th century (1999). He shows that the U.S. has chosen particularly hierarchical relationships where it has had great relationally specific investments, and that the debate among U.S. policymakers regarding foreign security cooperation has revolved around potentially opportunistic behavior by allies, the governance costs of hierarchy, and the military benefit of security cooperation, as predicted by the theory (Lake 1999). Although reaching mainly positive conclusions, Lake admits that his case studies "fall short of rigorous tests of the theory" (Lake 1999, 72-73).

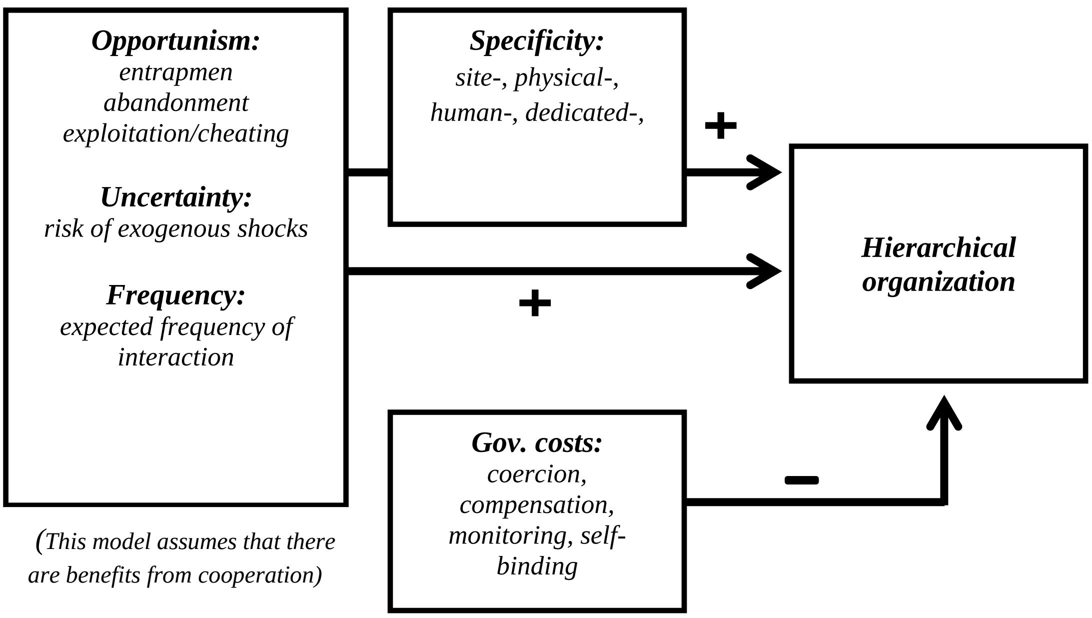
Weber tests the Transaction-cost theory through a series of case studies. In her study of the European Defense Community (the EDC) in the 1950s she concludes that "the combined assessment of threat and transaction costs does a good job of accounting for the Western powers' security choices in the early 1950s" (Weber 1997, 337). In her book (2000), Weber performs a qualitative test of a combination of realist and transaction-cost variables on eight different cases of security cooperation. Her cases are chosen from a large temporal domain, and they range from the security arrangements constructed during and after the Napoleonic wars, to the formation of NATO and the processes relating to the proposed European Defense Community in the 1950`s. She tests the effects of opportunism and non-behavioral uncertainty on the integration of military alliances, finding that high opportunism and non-behavioral uncertainty is related to highly integrated military confederations, like the confederation of German states or the Swiss confederation established after the Napoleonic wars (Weber 2000, 50-72). In cases where such organization were not chosen, she finds that variations in the preferences for institutional design varied with perceptions of transaction costs, both in the Napoleonic period and during the period after world war two (Weber 2000, 31-111).

Cha (2010) tests some of the arguments of the transaction-cost theory in a comparative study of U.S. bilateral alliances in Asia. He finds that fears of opportunistic behavior from autocratic Asian allies – as in the example mentioned above-, and especially fears of entrapment, had a large effect on the U.S.' choice to design alliances with Taiwan, South Korea and Japan in a hierarchical fashion. These alliances were "designed to exert maximum control over the smaller ally's actions" (Cha 2010, 158). Cha's findings are largely in accord with the predictions of the transaction-cost theory.[30]

[30] Cha calls his theory the "power play" theory of bilateral alliances, and he does frame his argument as an

To my knowledge, no quantitative studies have been published that explicitly test the transaction-cost theory of international security relationships. This is an important gap in the research program, and the theory needs to pass this hurdle before it can be deemed successful.

Figure 3 - The transaction-cost model of security hierarchies



3.3 The application of the theory to military alliances

I will here make the case for testing the transaction-cost theory in the domain of military alliances. As mentioned in chapter 2, some alliances are egalitarian, and include few provisions that can underpin a hierarchically integrated structure. Other alliances are highly integrated and hierarchical, opening up for the domination of the stronger state. In these alliances it is assumed that the weaker state cedes part of its decision-making capacity to the dominant state, and that this represents a relationship of dominance and subordination.

There are both theoretical and practical reasons for testing the transaction-cost theory in the domain of alliance-design. The theoretical reason is that we would expect the predictions made by the transaction-cots theory to hold in all areas where the following conditions are present: There is some benefit to the dominant state (polity) of establishing a cooperative relationship. This benefit will be threatened by non-behavioral uncertainty, costs that are hard to specify, and opportunistic behavior, which all are particularly threatening when specific

explicit test of the transaction-cost theory (Cha 2010).

assets are at risk. These transaction-costs can only be dampened in an integrated hierarchical governance structure. If various forms of egalitarian and hierarchical alliances san be placed on a continuum of relational strategies with extreme hierarchy on the one end and unilateralism on the other – an assumption of this thesis – then we would expect the transaction cost theory to be able to explain why some alliances are designed hierarchically, with an integrated security structure, while others are designed without such safeguards. If this argument holds, then military alliances should constitute an important test of the transaction-cost theory.

The practical reasons for applying the theory to this domain have to do with data quality and the need for a rigorous quantitative test. The data on international alliances are superior to the data on all other security relationships. The Alliance Treaty and Provisions (ATOP) dataset (Leeds et al. 2002), version 3.0, that I will use in the forthcoming analysis, includes high-quality information on alliance design, and it is designed to merge easily with the most commonly used datasets in IR. A database with a more exhaustive list of security relationships at the dyadic level, ranging from unilateralism and egalitarian alliance relationships to empires and colonies, does not currently exist.[31] Since the research on this subject is in its infancy, and since the argument has not been tested quantitatively before, we should use the data that is currently available, and see if the expected relationships are present.

A third argument for studying alliances in this context is that the field of alliance research is well developed, with an emphasis on replicable and cumulative findings. Since the questions of alliance-design, alliance termination, alliance-partner reliability and alliance formation are intertwined, the findings of this thesis may have implications for the alliance literature more generally. If so, they can be integrated in other research projects on military alliances.

One argument against studying alliance design without including other less and more hierarchical forms of security cooperation is that we are in danger of truncating the values on the dependent variable. Since we cannot observe all the values along the unilateralism-hierarchy continuum, we lose inferential strength when we move from saying something

[31] As I will argue later, this should be on the agenda for future research. One way to do this would be to select a random sample of dyad years, and code them using historical sources. The list to sample from would have to be a list of polities, not states, since a list only including states would bias the sample because it would exclude certain values on the dependent variable.

about alliance design to saying something about hierarchy in general. Nevertheless, the reasoning behind my choice of research design is that *given* that a transaction-cost theory is fruitful in studying hierarchy, we would expect its predictions to hold in a study of alliance design. A positive or negative result here, would give us some indication of the strengths and weaknesses of the theory, and it could serve as a guiding light for future research. This issue will also be discussed in chapter 4.

3.4 Summary

Above I have shown how a transaction-cost theory of economics has been applied to the topic of hierarchical security relationships, and how this approach can be tested in the well-researched domain of military alliances. To summarize, the transaction-cost theory makes the following claims: First, security is a “good” that can be transacted in a way analogous to a commodity in economics, and it will only be chosen when there is added value in a cooperative relationship. Second, this benefit is endangered by the prospect of opportunistic behavior, and exogenous shocks, the costs of which rise with the degree of relational specificity in the relationship. Opportunistic behavior can take the form of defection, entrapment or cheating, while exogenous shocks are assumed to occur more often when there is higher non-behavioral uncertainty. Third, the security relationship will be arranged in a way that will minimize the risk of opportunistic behavior and the sensitivity to exogenous shocks. The benefits of such a governance structure are assumed to rise when the expected frequency of interaction is high, while factors that entail high governance costs make the governance structure less attractive. A high likelihood of opportunism and exogenous shocks, a high expected frequency of interaction, and relational specificity are assumed to push in the direction of hierarchical governance, while high governance costs are expected to push in the opposite direction.

This theory should have explanatory power in the domain of alliance design, since alliances can function as hierarchical governance structures that curtail the autonomy of partners.

4. Research design

In this chapter I will develop a research design that can enable a quantitative test of the transaction-cost model of hierarchical alliance design. First, I will briefly make the case for testing the transaction-cost theory by way of a statistical analysis. Secondly, I will discuss my unit of analysis and its relation to the universe of cases I am making inferences to. I will here discuss possible sources of bias that might be related to the combination of my unit of analysis and the transaction-cost variables. Thirdly, I will draw on a range of trusted and much used datasets and variables from the quantitative IR literature, to find proxy variables for the theoretical concepts that make up the transaction-cost model. I will operationalize variables that are related to opportunistic behavior, non-behavioral uncertainty, the expected frequency of interaction, relational specificity, and governance costs. In addition to this, I will present a set of control variables that are grounded in explanations from more mainstream branches of IR theory. These control variables will constitute a baseline model of hierarchical security relations, which the performance of the transaction-cost variables will be evaluated against.

4.1 The case for a statistical analysis

The general argument for a large-N quantitative analysis is clear: Theories with empirical support from case-studies, and comparative studies with a small N, should be tested on a large group of cases to increase their generalizability and to lower the danger of selection bias.

There are two interesting objections to employing a statistical model to test the theory. One has to do with problems of operationalization, and this will be discussed later in this chapter (section 4.3). The second argument has to do with the usefulness of analyzing the cost-benefit calculations of strategic actors by looking at the *individual* effects of different cost- or benefit- proxy variables. This objection runs as follows: Since costs and benefits enter the calculations of policymakers as components, while the aggregate *output* of that cost-benefit calculation is what produces the effect, many of the variables in the transaction-cost model might be drowned out by countervailing costs and benefits in each case. In other words, the intricacies of the cost-benefit calculations are extremely hard to model, since the impact of each cost and benefit is contingent on the precise values of all the other costs and benefits. Adding to this problem is the fact that we lack a common metric with which to assess the precise values of the costs and benefits that enter the calculus of the actors.

For these reasons, cost-benefit models are often analyzed deductively, by constructing an expected utility model and looking at the output of the model given certain combinations of parameter values (for examples, see Samuelson (1983)). Such an enterprise has the benefit of being able to represent the complex interrelationships between the different cost- and benefit parameters in a model and their aggregate outcomes, reflected in the choices of policymakers. At the same time, this form of modeling is hard to test empirically, since we do not have a precise and definite metric for evaluating the various costs and benefits in the transaction-cost model.[32] Since this is out of our reach, we must settle for the second-best option of testing the effects of variables that are assumed to capture the costs and benefits entailed by different options. Even though it might not represent the complex utility calculations assumed by the transaction-cost theory, it will tell us which variables are particularly important, and, in turn, which variables will yield predictive knowledge of causal relationships, knowledge which is especially valuable to policymakers and other practitioners. This counts in favor of using a statistical model. It will not provide an exhaustive test of the transaction-cost model, but it will give us useful knowledge about which factors are decisive in producing the outcome.

4.2 Dataset and unit of analysis

My unit of analysis is military alliances, and, more specifically, the individual choices of alliance design. I will treat the first year of each alliance as the "decision point" at which the alliance design is chosen. My data is structured as dyad-years (a dyad is simply a pair of states), and the first dyad-year in each alliance corresponds to a decision point. Data on alliances are taken from the Alliance Treaty Obligations and Provisions dataset (ATOP) (Leeds et al. 2002), version 3.0. This dataset covers all formal alliances in the period from 1815 to 2003, and it is one of the two most widely used datasets on international alliances, the other being the Correlates of War (COW) project`s international alliance dataset (Gibler and Sarkees 2004). The ATOP dataset contains more information on the particular design features of each alliance than the COW dataset, and this makes it better suited for my purposes. The ATOP set is widely used in IR scholarship. It is based on the actual documents that constitute the alliance-treaty. Since these documents are original and relatively easy to code, I consider the ATOP set to be a reliable data source.

[32]One approach to empirical tests of formal expected utility models in political science can be found in the so-called EITM (empirical implications of theoretical models) approach. For an argument for such a strategy, see Achen (2002).

Two problems arise in relation to my unit of analysis. The first problem concerns the difference between bilateral and multilateral alliances, while the second problem concerns the danger of selection bias. I will here discuss these problems in turn.

4.2.1 The problem of modeling multilateral alliances

Since the theory being tested is dyadic, meaning that the interaction that is assumed is between a dominant state and a potential subordinate, there are problems related to the treatment of multilateral alliances because they consist of more than two actors. There are several ways to deal with this. One possibility is to include multilateral alliances and treat each dyad as an independent alliance pair, perhaps by treating the most powerful state in each dyad as the dominant state. In the NATO alliance, the dyad Norway-Turkey would then be treated as a relevant case on a par with the United States-Norway dyad, and Turkey would be treated as the potentially dominant state in the Norway-Turkey dyad. Needless to say, this would not make much sense. Hierarchical relationships in multilateral alliances like NATO are probably much more intricate than the dyadic level allows for, and a disaggregation of multilateral alliances into dyadic components would cloud rather than clarify the relational patterns in these alliances.

A more appealing option would perhaps be to pair all states in a multilateral alliance with the most powerful state in that alliance, and thus to apply a form of "relevant-dyad" logic (Lemke and Reed 2001) to military alliances. In this case, we assume that one decision has to be made for each potentially subordinate party in the alliance, such that an alliance between the most powerful state, i, and the weaker states j_1 and j_2 will be treated as two design decisions; one for j_1 and one for j_2. The countries mentioned in the NATO example would then only be paired with the United States, which is the most powerful country in NATO, and Norway and Turkey would only be included as US-Norway and US-Turkey, which would make more intuitive sense in the case of NATO. However, there are several reasons not to do this. First, because it would only include heavily asymmetrical dyads (in terms of military power), and this selection bias towards high-asymmetry dyads would make it hard to say anything about the effects of power symmetry on hierarchical organization. Secondly, it would be blind to the possibility that the dominating tendencies of the most powerful state can be held in check by a coalition of other alliance members who, when aggregating their capabilities, can constitute a reliable counterweight to the power of the most powerful alliance member. Thirdly, as Poast (2010) has argued, a data-generating process that is a product of interaction between more than two actors will yield misleading estimates when studied by looking at dyadic data (Poast 2010, 408-409), and multilateral alliances are alliances where such non-dyadic processes can be expected to dominate.

The third option is to exclude multilateral alliances altogether by restricting my focus to bilateral alliances. Since the theory I am testing assumes dyadic interaction, and since modeling multilateral hierarchy patterns would be too complicated a task for this thesis, I have chosen to go with this last option in my main analysis.[33]

The ATOP dataset (version 3.0) contains information on alliances formed in the period between 1815 and 2003. This will be the temporal domain of my study. I have chosen to exclude all alliances that are pure nonaggression pacts or neutrality agreements, as I do not consider such agreements to be direct forms of security cooperation. There are 208 bilateral alliance-decision points in my dataset, and these decision points are structured as dyad-years.

Since this dataset is supposed to include *all* formal alliances in this period, this is not technically a sample. The universe of cases I am making inferences to will primarily be the total pool of dyadic alliance relationships in the past, present and future. However, I am also making inferences from my results to security hierarchies in general, and, by implication, to other forms of hierarchy, like empires, protectorates, and protectorates. In this last universe of cases we find all dyads where there are benefits to be had from security cooperation. We should be more skeptical of the last inference, because it is made at a more abstract and general level and because it depends on the similarity of phenomenon like empires and hierarchical alliances, which is an untested assumption in this thesis.[34]

4.2.2 The danger of selection bias

Another objection to my unit of analysis is the possibility of selection bias. Selection bias occurs if our sample of cases is skewed towards a particular combination of values on the dependent and independent variables (King, Keohane, and Verba 1994, 126-138). If any of the variables I have included correlate with the choice to ally or not, *and* with the choice of alliance design, then the possibility of bias through selection effects might be present. For example, extreme values on the opportunism and governance-cost variables might be

[33] This is also done in Leeds and Savun (2007, 1125), and Leeds, Mattes and Long (2009, 469).
[34] As a final note of caution, it should be pointed out that the general assumption of dyadic interaction in alliance-studies is not above criticism. Warren (2010) argues that the mainstream approach to modeling alliance decisions is wrong in assuming dyadic interaction, and that alliances should be modeled as evolving networks through the use of stochastic actor-oriented models (Warren 2010, 201). This criticism might also apply to the modeling strategy employed in this thesis, although to a lesser degree than to studies of alliance formation in general since I am studying bilateral alliances where the assumption of dyadic interaction is more appropriate.

excluded from our data, since these extreme values might preclude alliance formation (even with a hierarchical design) in the first place, because they might result in more extreme forms of hierarchy, like empires, confederations or protectorates.[35] This might omit some variance on the independent variables, and give us less confidence in the inferences we draw from the analysis. Nevertheless, when we stick to bilateral alliances as our unit of analysis and domain of inference, we should observe that high potential costs of opportunism, non-behavioral uncertainty, high frequency and low governance costs *for allied states* will make hierarchical alliance design more likely. A more thorough analysis would study all dyad years, and include all possible forms of hierarchical organization as dependent variables, but this is beyond the scope of this thesis.

4.3 From theoretical model to proxy variables

Moving from a theoretical model to an empirical test is a perilous journey, especially when we are dealing with rather abstract concepts like the variables in the transaction-cost theory. A substantial problem in this regard concerns the correct measurement of the variables in the theory. It is hard to make sure that we are actually measuring the concepts in the theory, and not some other related phenomenon. Operationalization has always been a problem for empirical tests of the TCE theory. It has been a major obstacle to test the theory in econometric studies (Shelanski and Klein 1995, 339), and it is one of the main reasons why Lake chose to conduct a qualitative test of the theory in his analysis of U.S. security policy (Lake 1999, 72-73). Operationalization is thus one of the most formidable tasks of this thesis. This is primarily because most of the variables are currently directly unobservable. We cannot observe a hierarchical relationship or a disposition to behave opportunistically directly, since the most basic constituents of authority relationships are the preferences and beliefs of individuals.

This is by no means an argument against trying. It rather means that we must settle for measuring the empirical traces of these phenomena by using proxy variables that are assumed to pick up part of the theoretical concepts. These variables will thus represent the concepts

[35] An alternative model where the problem of selection bias would be much smaller would be one where I studied *all* dyad years in the period chosen, and coded these relationships on the spectrum from egalitarian to hierarchical relations. I would then have to include many other forms of hierarchical and non-hierarchial security relationships (colonial dependencies, protectorates, informal but egalitarian cooperation etc.) as these would be possible outcomes on the dependent variable. There is currently not enough data available to attempt such a design, and collecting those data would be too time consuming for this research project.

we are trying to measure indirectly.[36] Non-observable concept and observable proxy variable can be linked by a process of abductive reasoning, or what is sometimes called *inference to the best explanation*, where we infer the presence of the unobservable phenomenon by measuring an observable one, like inferring that someone is happy (a non-observable mental state) by observing their smile (an observable external sign).[37] All proxy variables in my research design will either be linked to the theoretical concepts by drawing on empirical research, or by logical implication.

One problem with the use of proxy variables is that they can plausibly represent *many* theoretical concepts, making it hard to draw determinate conclusions from the performance of individual variables. This is also a problem in my analysis. I have therefore chosen a strategy where I try to find several proxy variables for each independent variable. If most of the variables are insignificant and/or pull in the wrong direction from what I expect, this should weaken our confidence in the TCE model, and strengthen it if the opposite is the case. Furthermore, if a proxy shows the expected empirical relationship and no other interpretation than the transaction-cost theory is on offer, this should strengthen our confidence in the theory and point in the direction of where further research is needed. This strategy rests on the assumption that there are few, if any, individually satisfactory measures of the variables in the transaction-cost model that we can currently observe. The main question we must ask then is not whether all of these variables are exhaustive and determinate measures of the variables in the theory, but whether they will pick up the pattern we would expect to see if the theory is an accurate explanation, and whether they will provide us with a better explanatory model than we had at the outset.

4.4 Dependent variable: Hierarchical organization

The dependent variable is the choice of alliance-design in the dyad. An alliance can either be designed with hierarchical safeguards or without them. When operationalizing this variable I have decided to draw on the military institutionalization index, developed by Leeds and Anac (2005, 188-189), which has later been used in studies of international mediations (Savun 2008), military strategy (Wallace 2008), and alliance-partner credibility (Leeds and Anac

[36]Indirect observation is by no means particular to this study. It is the case in a wide range of studies of natural and social phenomena, like power, genes, democracy, market behavior, natural selection, or even elementary particles.

[37]Abductive reasoning takes the logical form: A is a *sufficient* condition (not a formal condition as in deductive logic) for B. We then infer A from observing B. For a classic formulation of the concept of abductive reasoning, see Charles S. Peirce (1998).

2005; Leeds and Savun 2007). My operationalization is a revised version of that index.[38] I give my dependent variable, *hierarchy,* a score of 1 if an alliance includes provisions for (A) a common defense policy; *or* (B) an integrated military command during peacetime and wartime; *or* (C) alliances that allow one of the partners to place troops or bases on the soil of the other member, while this right does not extend the other way.[39]The variable gets scored as 0 if neither of these features are present. In the data we find 58 bilateral alliances that are hierarchically designed, amounting to 28% of the cases.

The dependent variable is the most important variable in the analysis, and we need to make sure that this indicator actually measures the theoretical concept it is supposed to measure. This is referred to as *measurement validity*. To establish that my operationalization has validity, I will first discuss whether the indicator corresponds to our best intuitions of the theoretical concept, and then I will conduct a series of tests for *convergent*, *discriminant*, and *nomological* validity, as proposed by Adcock and Collier (2001).

I will argue that all three provisions that make up the hierarchy measure are intuitively related to the theoretical concept, and that they should be combined in one dichotomous measure. All three components of the *hierarchy* indicator reduce the autonomy of the subordinate state, this reduction of autonomy happens with some degree of consent from the subordinate, and this implies the ceding of *authority* which links the operationalization to the theoretical concept. I will here go through each part of the indicator in turn.

The first component; provisions for a common defense policy, is a proxy for hierarchy insofar as it implies that the most powerful state will gain control of the defense policy of the weaker party and thus reduce its autonomy. I am here assuming that an integrated defense

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[38]The original Leeds and Anac index (Leeds and Anac 2005, 188-190), which goes from 2 to 0, includes a moderate level of institutionalization where an alliance is scored as 1 if it (A) requires official contact between military officials during peacetime; or (B) requires one party to provide training and/or technology for the military of the other party; or (C) includes specific plans for the subordination of the military of one party to the military of the other in times of war. I will not include any of these measures of moderate institutionalization, since I do not think they tap hierarchy adequately. Whereas the first measures more directly measure military integration, and, by implication, hierarchy, the moderate level includes measures that must be assumed to be simple functions of cooperation, and do not directly relate to the autonomy of the members .

[39](A) is a dummy variable constructed from the variable *MILCON* in the ATOP dataset, and the score 3=common defense policy, and (B) is the dummy variable *INTCOM* in the ATOP dataset. In the military institutionalization index, (C) is a combination of the variables *BASE* and *CONTRIB* in the ATOP dataset (Leeds 2005, 28). Here it is scored as 1 even if the alliance only requires joint troop placements in neutral territory or symmetrical troop placements. I do not consider this to be an indication of hierarchy, as I require *asymmetrical* troop placements in the territory of members for this variable to count as 1. By using the logical operator “or”, C in the original index also includes the variable CONTRIB which measures whether or not specific military contributions (like troop levels, funds etc.) are required in the event of conflict. I have excluded *CONTRIB*, , since I do not see how this can be linked to hierarchy. Troop placements is then the only relevant variable in the C component of the measure. Removing *CONTRIB* and changing *BASE* (to exclude troop placements in neutral territory) is an attempt to reduce “noise” in the measure.

policy leads to a lack of policy autonomy for the weaker state because bargaining power in the internal decision-making process relating to common defense policy will be determined by the asymmetries in material military power between the states in the dyad. Anecdotal evidence suggests that this is often the case. The bilateral alliances between post-Soviet Russia and former Soviet republics, like Turkmenistan, Tajikistan and Uzbekistan in the 1990`s are examples of how an integrated defense policy served as a tool of hierarchical domination in the successor states (for examples, see Menon 1995; Roeder 1997).

The second component of our measure is whether or not the alliance in question requires an integrated military command during both peacetime and wartime. An integrated command gives the dominant state an influence over the subordinate`s defense policy in many of the same ways as a common defense policy does. It rests on the same assumption as the one linking a common defense policy to hierarchy: Bargaining power in the integrated command is assumed to be based on material power. Two good examples of integrated command structures that are clearly hierarchical are found in alliances between Panama and the USA (1977), and between the Soviet Union and Estonia (1939). Relations between Panama and the U.S. have been described as an informal "empire" (Lake 2009b, 59), and the agreement between The Soviet Union and Estonia was followed by Soviet occupation one year later (this is the cause for termination cited in the ATOP code sheet, alliance number 2475 (Leeds et.al 2000b)). In integrated military commands and through common defense policies, the integration of policymaking processes leads to a loss of autonomy for the weaker state, and since this loss of autonomy is consented to by the weaker state, it signifies the establishment of a relationship of political authority.

The third component is whether or not one state in the relationship has the right to place troops on the soil of the partner while this right does not extend to the partner. A state with another state`s troops on its soil gives this state influence over its security policy. The troops of state *i* can attack a third party from *j*`s territory and thus involve *j* in the conflict and make its territory a target. It can also restrain *j*`s independent security policies by acting as a pacifying deterrent.[40]

There are several reasons for putting the three indicators together in one dichotomous measure. First, there are theoretical reasons for doing so. The individual indicators all signal

[40] Since we do not have data on *which* state gains the asymmetrical right, it is assumed that it is the more powerful state that has the right to place troops in the weaker ally. Inspection of the coding sheets for the alliances where this provision is included show that this is almost always the case (coding sheets (Leeds et.al 2000b) can be found at http://atop.rice.edu/

an autonomy loss for the weaker state, and this loss is accompanied by a measure of consent on the part of the subordinate. Thus, they all share the theoretically relevant property. This means that each of the provisions can function as substitutes for the others, so that the inclusion of one provision makes the inclusion of another less desirable. In this way, the implementation of an integrated command structure might reduce the need for a common defense policy, and vice versa. The dichotomous indicator I have suggested is well suited for picking up this *interchangeability* of the different provisions. Second, combining the indicators reduces the chance that random noise in the individual measures will influence our findings. This makes it more likely that the tendency we are interested in will show in the data.

To further establish the validity of the *hierarchy* variable, we can test for *convergent*, *discriminant*, and *nomological* validity (Adcock and Collier 2001). Convergent validity is achieved when the chosen measure correlates highly with another indicator that is supposed to measure some part of the same theoretical concept (Adcock and Collier 2001, 540). I have checked for convergent validity by correlating *hierarchy* with a variable measuring whether or not the alliance agreement specifies whether one state can intervene in the domestic politics of another while this right is not reciprocal. This is another indication of a hierarchical relationship. Information on this provision can be found in the ATOP dataset. I create a dummy variable for this provision, and I find a significant and substantial correlation between the two, leading me to conclude that the variable has convergent validity.[41]

Discriminant validity is achieved when your chosen measure does not correlate highly with a measure that is supposed to track a theoretical concept that is related to, but distinct from the concept you are trying to measure (Adcock and Collier 2001, 540-541). To check for this I have correlated the hierarchy indicator with an indicator that measures non-military cooperation. This non-military cooperation variable can be interpreted as tracking *cooperation and capability aggregation* in general. If our hierarchy variable is just tracking the intensity of cooperative efforts rather than hierarchy – a plausible objection –, then it will correlate highly with other, non-hierarchical efforts at cooperation. I have checked for this by correlating *hierarchy* with a variable measuring whether there are provisions for non-military

[41]This is a recoding of the variable *INTERV* in the ATOP dataset. After recoding, 1=non-reciprocal provisions for one state to be able to lawfully intervene in the domestic politics in the other state (this provision corresponds to alternative 3=Rights of non-reciprocal intervention, for the *INTERV* variable), and 0 otherwise (Leeds 2005, 31).

cooperation,[42] and a variable registering whether there are provisions for any kind of military aid in the agreement.[43] The correlation between these variables and *hierarchy* is not significant. I therefore conclude that the variable has discriminant validity.

Thirdly, we must check for *nomological* validity, which is a matter of whether a previously tested causal hypothesis, which includes the theoretical concept that we are measuring as an independent variable, is borne out empirically when the cases are scored with the indicator we have chosen (Adcock and Collier 2001, 542). The previously supported causal hypothesis has to have been tested with a different operationalization of the concept than the one whose validity is being tested here.[44] I have done this by testing whether the hierarchy indicator has a significant negative effect on military expenditures. This relationship was first identified by Lake (2007), who showed that states that were in a hierarchical relationship with the U.S. spend less on defense than other states. The logic here is that hierarchical governance is accepted by the weaker state in return for protection by the stronger state.[45] To test whether the purported relationship is present when hierarchy is measured with my indicator, I test whether the logarithm of military expenditure correlates negatively with hierarchy for the weaker member.[46] I do this by using the Correlates of War dataset on National Material Capabilities (Sarkees and Wayman 2010) and I include all COW-listed states from 1815 to 2003. I find a significant negative correlation between being in a hierarchical military alliance and logged military expenditure.[47] I therefore conclude that my indicator has nomological validity.

Fourthly, we can inspect a list of cases that are scored with the hierarchy variable, and see whether this list matches our everyday intuitions of the concept. In table 2 I present a randomly drawn sample of 40 alliances (stratified to produce 20 hierarchical and 20 non-

[42]This is the dummy variable *NOMICOOP* in the ATOP dataset (1=provisions for non-military cooperation, 0= no such provisions) (Leeds 2005, 30).
[43]This is a recoding of the variable MILAID in the ATOP dataset (Leeds 2005, 27). My recoding makes 1=any provision for military aid, and 0=no provisions for military aid.
[44] An example of nomological validity can be found in the following: Say there is a proven relationship between economic growth and democracy, and this has been tested using the polity2 index of democracy. If we propose an alternative operationalization of democracy it has nomological validity if the relationship between growth and democracy persists when democracy is scored with the new operationalization.
[45] In Lake (2007), the indicator that is used is different from the one I am employing here, as that indicator is developed to apply specifically to U.S. hierarchy.
[46] I have operationalized this as a logarithm of military expenditure because I believe this variable to have a relative effect
[47] This was done by using the variable “milex” in the Correlates of War project`s National Material Capabilities data, version 4.0 (Sarkees and Wayman 2010), and the *hierarchy* variable from my dataset. The correlation is .1742 , and significant at the 5% level.

hierarchical alliances) and their scores on the *hierarchy* variable (1=hierarchical organization, 0=not hierarchical organization).[48]

Table 2 - Sample of alliances with values on the dependent variable

State A	State B	Year	Hierarchy
Austria-Hungary	Bulgaria	1914	0
Kyrgyzstan	Uzbekistan	1992	1
Czechoslovakia	Bulgaria	1968	0
United Kingdom	Egypt	1936	1
Albania	Yugoslavia	1948	0
United Kingdom	Libya	1953	1
Hungary	Romania	1948	0
Iraq	Jordan	1958	1
Hungary	Russia	1948	0
Libya	Syria	1980	1
Poland	Bulgaria	1948	0
USA	Panama	1977	1
France	Russia	1935	0
Germany	Austria-Hungary	1864	1
Italy	Sicily	1833	0
USA	Spain	1963	1
Czechoslovakia	Yugoslavia	1920	0
Netherlands	Spain	1816	1
Germany	Russia	1863	0
Austria-Hungary	Parma	1848	1
USA	Pakistan	1959	0
United Kingdom	Malaysia	1957	1
United Kingdom	China	1846	0
United Kingdom	Iraq	1955	1
Yugoslavia	(unknown)	1912	0
Austria-Hungary	Modena	1847	1
Germany	Austria Hungary	1854	0
United Kingdom	Ethiopia	1944	1
France	Comoros	1978	0
United Kingdom	Portugal	1943	1
GDR	Russia	1964	0
France	Djibouti	1977	1
GDR	Hungary	1977	0
Russia	Estonia	1939	1
United Kingdom	Russia	1941	0
Russia	Turkmenistan	1992	1
Austria-Hungary	Sicily	1815	0
France	Gabon	1960	1
Guinea	Liberia	1979	0
United Kingdom	Iraq	1930	1

[48] This has been done using the ".sample" command in STATA, v.11,0. Due to the randomizing procedure, the exact sample cannot be replicated.

A glance at this list strengthens the impression that *hierarchy* is tapping into the theoretical concept. The list includes few cases that are highly counterintuitive (false positives). A clear example of a false positive would be a case where an alliance between two great powers was coded as hierarchically organized.

At the same time, it includes many cases that we would expect to be coded as hierarchical. The United Kingdom`s alliances with territories under former British control, like Egypt (1936) and Iraq (1930), the USA with Panama (1977), France with Djibouti (1977) and Gabon (1960), and Russia with states in its sphere of interest like Estonia (1939) and Turkmenistan (1992) are examples of cases that should match our intuitions about hierarchical relationships.

4.5 Independent variables

In this section I will try to identify a set of valid proxy variables for the independent variables that, according to the transaction-cost argument, lead to hierarchical alliance design (for an overview of all independent variables, see table 4). The independent variables are identified by a subscript, indicating whether they refer to the stronger state in the alliance; *i*, the weaker state; *j,* or to the dyad as a whole; *ij*. Which state is weaker and which is stronger is defined by their varying degrees of military capability. This will be measured by using the composite index of national capabilities - the CINC score – from the Correlates of War Project`s National Material Capabilities dataset (Sarkees and Wayman 2010), version 4.0. This is the most commonly used measure of material capabilities in international politics. It is an indicator that ranges from 0 to 1 and it represents the average of a country`s share of the world`s total population, urban population, military personnel, iron and steel production, military expenditures, and energy consumption measured in metric coal ton equivalents (COW 2010, 7).

Some of the independent variables will be lagged by one year to guard against endogeneity, which occurs when the independent variable in year *t* is caused by the dependent variable (or by other independent variables) in that same year (Maddala and Lahiri 2009, 357).[49] This will be made explicit for each variable where a lag is appropriate.

For each variable I will derive a hypothesis that states how it is assumed to affect the independent variables. It is important to note that these hypotheses by themselves do not

[49] An assumption here is that the weaker state`s expectations of future subordination does not affect its current behavior. An example of this would be if state *i* became increasingly risk-acceptant in anticipation of the future hierarchical alliance.

constitute an adequate test of the transaction-cost theory, but that it is the overall performance of the transaction-cost explanation that will be evaluated in the quantitative analysis. Each of the variables capturing opportunism, frequency, and non-behavioral uncertainty will also be interacted with relational specificity, to test whether their effects depend on the presence of specific assets. A total overview of all proxy variables, the theoretical variables they are supposed to capture, their data source, and their related hypotheses can be found at the end of this chapter, in table 4.

4.5.1 The benefits of cooperation

According to the transaction-cost theory, the presence of joint production economies is a necessary condition for security cooperation. It is considered to be a function of the autonomy- or security-related value of cooperation for *i*, and the autonomy- or security-related costs of such cooperation compared to what it would gain by following a unilateral strategy.[50] Since I am studying dyads that have *already* chosen to ally, I have not modeled the benefits of cooperation explicitly. I assume that all the dyads that enter the dataset of allied dyads have already decided that there are such benefits of cooperation, and the key question is whether an alliance should be constructed with hierarchical safeguards or not. In other words, *given* that there are benefits to be gained from the alliance, the key question is what relational structure will best secure that these benefits are maximized. Since this means that the benefits of cooperation are held constant, I have focused on the variables of opportunism, non-behavioral uncertainty, frequency, relational specificity and governance costs.

4.5.2 Opportunism

According to the transaction-cost theory, factors that increase the probability and costs of entrapment, cheating and defection, will push in the direction of hierarchical organization. Since I have chosen the formulation of the theory which assumes that it is the stronger state`s preferences that are decisive, I will here present four proxy variables that will reflect *j*`s (the weaker state) disposition to behave opportunistically: Political instability, its risk acceptance, its institutional dissimilarity from the stronger state, and whether or not *j* is a democracy. Insofar as these factors are signals of opportunistic dispositions in the weaker state, we will expect them to make the stronger state more inclined to opt for hierarchical organization. The link between these four proxies and opportunistic behavior will in each case be supported by previous empirical research.

[50] How much *j* values the protection provided by *i* will determine how much autonomy it is willing to give up.

First, I assume that the degree of *political instability* in *j* should increase the probability of opportunistic behavior, like defection, entrapment or cheating. If a regime is politically unstable, the current political elite might not be around tomorrow to honor agreements made today. A prominent example of this is Lenin and the revolutionary Bolshevik government`s unilateral repudiation of several international agreements held by the former Tsarist regime (Prince 1942, 433-436). Several studies have found that a fundamental change in political institutions is associated with a lower probability that a partner will fulfill its obligations in an alliance (Bennett 1997; Leeds 2003a). Therefore, we should expect security cooperation with weaker states with unstable political institutions to be hierarchically designed. As a proxy for political instability, I have chosen to create a variable that measures the time since a regime change in state *j*. A regime change is a disruptive and fundamental change in political institutions, and countries with recent regime changes are more likely to experience a relapse than countries with long-lasting regimes (Gates et al. 2006; Hegre et al. 2001). This variable will primarily capture the opportunistic behaviors of defection and cheating, but it can also be seen as a weak proxy for the likelihood of entrapment since internal instability is associated with external aggression (Mansfield and Snyder 2002). Information on regime changes is taken from the Polity IV dataset, which is widely used in political science (Marshall and Jaggers 2002). I will here use the variable that measures the occurrence of regime change, where this is defined as "a three point change in the polity2 score over a period of three years or less) or the end of a transition period defined by the lack of stable political institutions (denoted by a standardized authority score)" (Marshall 2010, 17). The polity2 score is measured on an index that measures how democratic or autocratic a state is (+10=Most democratic, -10=least democratic).[51] I will operationalize the variable $instability_j$ as the temporal proximity of a regime change by creating a decay function measuring the time since regime change. This variable is defined as X=exp*(-years since regime change/a*) where *a* is a divisor that makes the value of the variable decline with the time since regime change. This operationalization is chosen to model the intuition that the likelihood of instability declines with time since the destabilizing event. This variable yields the following hypothesis:

[51] This polity2 score is a combination of the democracy indicator and the autocracy indicator in the Polity IV dataset. The polity2 scale consists of "codings of the competitiveness of political participation….,the openness and competitiveness of executive recruitment …., and constraints on the chief executive" (Marshall 2010, 14-15). The polity2 scale is constructed by subtracting the autocracy indicator from the democracy indicator. It is a version of the polity scale, that has been constructed to make the measure more appropriate for time-series analysis (Marshall 2010, 17).

H1a: Political instability in the weaker state makes allies more likely to design alliances hierarchically

Secondly, I will include the variable *risk attitude*$_j$ that measures the risk acceptance or aversion of the weaker state. This will primarily serve as a proxy for the likelihood of entrapment caused by moral hazard (see part 3.2.3). States that are risk acceptant are assumed to be more likely than risk-averse states to gamble and take on the costs entailed by attacking neighbors. The risk variable is computed by using a particular operationalization that is based on Signorino and Ritter`s (1999) "s-measure" of foreign policy similarity. The measure is a version of Bueno de Mesquita`s (Bueno de Mesquita 1981) widely used tau-b measure of interest similarity, which can be used to compute variables that measure risk aversion and risk acceptance. Bueno de Mesquita`s measure has been described as a "de facto academic standard" (Bennett and Stam 2000b, 541). The s-measure treats the policy portfolio of a state as a signal of its preferences. A policy portfolio can incorporate elements like formal alliances, trade patterns, and votes in the UN general assembly (Signorino and Ritter 1999, 128). It is a "spatial" measure of foreign policy similarity. When it is only used to measure association between two states, it measures the closeness of the choices of these two states over a range of revealed foreign-policy positions (Signorino and Ritter 1999, 126). Simply put, if two states have the same policy portfolio they get the highest score on the s-measure. To use the s-measure to compute an indicator of the risk attitude of a given state, three steps are taken, and I will here use Germany as an example to illustrate the procedure: First, one calculates the *hypothetical* foreign-policy portfolio that would maximize security for Germany in a given year. This can be done either regionally or globally. The security-maximizing portfolio is the one that is most similar to the portfolio of the most powerful states (either globally or regionally). In spatial terms this is a measure of the policy portfolio of the given state`s closeness to the policy portfolio of the most powerful states. Second, one calculates the security generated by the *actual* policy portfolio – by summing up the power of the states Germany has a similar portfolio to, weighted by their s-measure with Germany, and subtracting the power of all the states Germany has a dissimilar portfolio to, weighed by their s-measure with Germany. In our example, the discrepancy between the actual and the optimal security portfolio gives us a measure of the degree to which Germany *values security above other things* (Bueno de Mesquita and Lalman 1992, 292-293). The measure ranges from -1(risk averse) to +1 (risk acceptant). A state that values security above every other policy priority would maintain the policy portfolio that would maximize its security. To exemplify, Germany had a regional risk score of -.22 on the eve of the First World War in 1914, while its risk score drops to -.79 in 1919, as its bid for European hegemony had been thwarted by the allied powers in the war.

Due to lack of data for the other components, I will here use alliance patterns as the input to the s-measure, and I will use the EUgene data compiling software, version 3.204 (Bennett and Stam 2000a), to get data on this variable.[52] This program uses updated raw data from the Correlates of War project and other sources, and a sophisticated computer algorithm to calculate the hypothetical and actual alliance-networks that serve as inputs to the risk measure (Bennett and Stam 2000a). Risk attitudes are calculated for each state-year, and I will here use the *regional* risk measures as a proxy for the weaker state`s risk attitude, as this more accurately reflects the likelihood of moral hazard. On this operationalization the most regionally risk averse states in my dataset are Senegal (1974) and Uzbekistan (1992). In Uzbekistan's case, this is probably due to the lack of regional alliance ties at the moment of independence. Other states with very high regional risk acceptance scores are Cuba (1986), China (1950), and Syria (1966).

This variable is lagged by one year to guard against endogeneity.[53] The reasoning behind the inclusion of this variable yields the following hypothesis:

H1b: A risk acceptant weaker state makes allies more likely to design alliances hierarchically

What *types* of regimes are more prone to opportunistic behavior is a topic of great scholarly debate. Leeds, Mattes and Vogel (2009) argue that democracies are less inclined to violate their international commitments because electorates value policy consistency, and because "democratic institutions contain checks and balances that make dramatic and sudden policy change difficult" (Leeds 1999, 985-988; Leeds, Mattes, and Vogel 2009, 475). In opposition to this argument, Gartzke and Gleditsch (2004) present two formal arguments, and statistical evidence to suggest that democracies are actually *less* reliable alliance partners than other regime types. They argue that since democracies are more sensitive to the preferences of citizens, they will be more likely to abandon their alliance commitments when these

[52] The earliest version of the risk-attitude measure in the literature, tau-b, only included alliances. I do not consider the use of alliances as the input to the s-measure as a problem. I believe alliance-patterns are a good measure of policy priorities when it comes to *security* – which is what interests us here. One may perhaps object that endogeneity will be a problem here because we are studying alliances while using alliance-patterns as input to one of our independent variables. This is not a big problem however, because we are only studying allied states, meaning that the propensity to ally or not (which would influence alliance-patterns) is held constant across all our observations.

[53] Since risk attitude may be affected by the security guarantees contained in the alliance in the year of the alliance-decision point.

commitments are costly, so that "when most needed, democracies may simply fail to show up"(Gartzke and Gleditsch 2004, 781).[54] This makes democracies less credible when push comes to shove, and thus more prone to opportunistic behavior (Gartzke and Gleditsch 2004, 782).[55] To see if any of these arguments are right, I have chosen to include the variable *democracy*$_j$, which is computed with data from the Polity IV dataset (Marshall and Jaggers 2002)[56] and the polity2 index (described above). *Democracy*$_j$ is computed as a dummy variable, and I have given it a score of 1 for any score equal to or above 5 on the polity2 scale, and 0 otherwise.[57] 85 (44%) of the alliances include potential subordinates who are democratic. *Democracy*$_j$ is lagged by one year to reduce problems of endogeneity, since it has been shown that alliances can affect regime-type (Gibler and Wolford 2006).

If Leeds, Mattes and Vogel (2009) are correct, democratic subordinates should be more credible, requiring less hierarchical safeguards to keep them from behaving opportunistically. If Gartzke and Gleditsch (2004) are correct however, the opposite pattern will show in the data. In other words, since research suggests that democracy is either negatively or positively associated with opportunistic behavior, we expect to see either a negative or a positive association between democracy in the weaker state and hierarchical alliance design. This yields two competing hypotheses:

H1c: When the weaker state is a democracy, alliance members will be more likely to design alliances hierarchically

H1d: When the weaker state is a democracy, alliance members will be less likely to design alliances hierarchically

It has been argued that *regime dissimilarity* is related to a higher likelihood of opportunism in an alliance relationship. Leeds develops a formal model of alliance formation, and argues that

[54] Another point made is that interest groups will have a greater say in deciding to *ally* with a given state, while the decision to intervene in a conflict on its behalf will be up to the broader public, as getting involved in a conflict is more costly to the electorate than just promising to do so.

[55]The dependent variable in Leeds et.al (2009) is premature alliance termination, and in Gartzke and Gleditsch (2004) it is the actual decision to come or not to come to an ally`s aid when it gets involved in a military dispute. The transaction-cost theory leads suggests that Leeds, Mattes and Vogel`s dependent variables might be biased by hierarchy. Democracies might stay longer in formal alliances because those alliances are sprinkled with hierarchical safeguard mechanisms that keep them from defecting *precisely* because they are viewed by their partners as less credible.

[56] The dataset is updated annually, and I am here using the latest version available, from 2009. This can be downloaded at http://www.systemicpeace.org/inscr/inscr.htm

[57] This is a quite generous threshold, but it is still only marginally different from 6, which is most commonly used in the literature. I use 5 to be better able to pick up states that were democratic in the 19th century, where the threshold of 6 would include some states we would normally call democratic by the standards of their time. One example of this generous threshold being used is Leeds (2003a, 821)

jointly democratic states are more likely to view each other as more credible partners (Leeds 1999), and, conversely, that dissimilar regimes will view each other with more suspicion. The logic behind this argument is similar to the argument concerning *democracy*$_j$ above: Leaders in democratic states are more likely to uphold public promises and commitments because they will get punished by voters for not doing so, and because checks and balances lower the speed of policymaking and policy change (Leeds 1999, 985-988). Autocracies on the other hand, are assumed to have much more domestic autonomy, allowing for radical shifts in policy when it is required (Leeds 1999, 988). Such flexibility enables autocracies to respond quickly to the actions of the partner, and it makes them less vulnerable to sudden external policy shifts, since they can quickly adapt accordingly (Leeds 1999, 988). In short, democracies face high costs if a partner defects, but they are more credible, while autocracies are less credible but more capable of absorbing the costs of defection by quickly changing their policy. This implies that democracies will see fellow democracies as more credible partners, and that autocracies are more likely to accept the high risks of making commitments to other autocracies (Leeds 1999, 990). Following this logic, alliances between dissimilar regimes are more likely to be designed with hierarchical safeguards that can guard against opportunistic behavior.[58] I have therefore chosen to include the variable *regime dissimilarity*$_{ij}$, which measures the absolute difference in the polity2 scores on the autocracy-democracy scale (-10= total autocracy, 10=total democracy) of the two states in the dyad. This variable is lagged by one year to reduce endogeneity problems (same as for *democracy*$_j$). I have calculated this variable so that it ranges from 0 (identical polity2 score) to 20 (most dissimilar polity2 score). This variable yields the following hypothesis:

H1e: Regime dissimilarity makes alliance members more likely to choose hierarchical organization

To summarize, I have identified four proxy variables that are supposed to capture the probability of opportunistic behavior. These are *instability*$_j$, *risk attitude*$_j$, *regime dissimilarity*$_{ij}$, and *democracy*$_j$.

4.5.3 Non-behavioral uncertainty

[58] It is here assumed that this will happen even in cases where the stronger state is an autocracy and the weaker state is a democracy (a relatively rare occurrence in the data). Firstly, because the flexible stronger autocracy, *i*, will have to build confidence in *j* by constructing a tighter relationship. Secondly, because *i* will want the slower weaker democracy to adapt to changing circumstance at the same speed as itself.

In addition to the uncertainty arising from opportunistic behavior, there is non-behavioral uncertainty, arising from the international environment facing the states in the alliance. Leaders may be uncertain about the preferences, actions and capabilities of adversaries and allies, the future development of those interests and capabilities, and their adversaries` and allies` willingness to take risks in responding to international situations. If uncertainty is low, it is easier to commit *ex ante* to agreements about future behavior. If uncertainty is high, such contracting becomes much harder, and it is more likely that commitments have to be safeguarded by a hierarchical organizational structure to be made credible. I have chosen to define two proxy variables for non-behavioral uncertainty.

The first proxy for non-behavioral uncertainty is operationalized by following Bueno de Mesquita and Lalman (1992, 298) in using the combined variance in risk attitudes across states in a given year, where risk attitudes are operationalized as mentioned above. The variable will be lagged by one year to guard against endogeneity.[59] The assumption here is that decision makers are uncertain about "how any one nation will respond to a risky situation" (Bueno de Mesquita and Lalman (1992, 298). This variable, *risk score variance*$_{ij}$, will be included as one proxy for international uncertainty, and it will be linked to the following hypothesis:

H2a: High yearly variance in risk attitudes makes allies more likely to design alliances hierarchically

It can be argued that another proxy for non-behavioral uncertainty can be found by using the fluctuations in the *capability distribution* in the international system. I assume that a fluctuating distribution will generate uncertainty for policymakers about the future and present distribution of power. The rise of new great powers, and the decline of old ones, is often accompanied by wars, crises and convulsions in the international system, making international actors uncertain about future equilibriums and constellations (Gilpin 1981; Kennedy 1989; Kugler and Lemke 1996). I have therefore defined the variable *capability fluctuation*$_{ij}$ as the mean difference in the year-to-year capability scores (measured in CINC scores) for all great powers in the system. I have used the COW list of great powers to identify which states qualify as great powers (Sarkees and Wayman 2010). The relationship

[59] Since the variance in risk scores is computed with alliance data, the decision to ally in a given year and the general composition of alliance-portfolios *at the systemic level* may be correlated. I have therefore decided to lag this variable. Uncertainty changes quite slowly, so this choice is not of great consequence.

between this variable and hierarchical organization can be expressed in the following hypothesis:

H2b: High year to year fluctuations in the capabilities of the major powers make allies more likely to design alliances hierarchically

4.5.4 Frequency

According to the transaction-cost theory, the greater the frequency with which interaction is expected to occur the greater the long term *benefits* of hierarchical organization, and the greater the costs of egalitarian cooperation, since the distribution of costs and benefits of the relationship becomes increasingly hard to specify as circumstances change (see sec. 3.2.3). This effect is compounded by relational specificity. The expectation that interaction will be high in the future will thus increase the conviction that a hierarchical structure will pay off. To model this relationship, I have here included two variables that are supposed to tap the *expected* frequency of interaction between *i* and *j*.

The first proxy for frequency measures whether or not state *i* and state *j* have shared a long time rivalry with another state. Goertz, Diehl, and Klein (2006) define a rivalry as "a longstanding competition between the same pair of states." (Goertz, Diehl, and Klein 2006, 331), where "the expectation of a future conflict relationship is one that is specific as to whom the opponent will be." (Goertz, Diehl, and Klein 2006, 333). The importance of the expected frequency of interaction, and especially when defined as expectations of a shared long-term rivalry, is highlighted by Weber (2000, 45). I have defined $\textit{shared rival}_{ij}$ as a dummy variable, scored as 1 if the states in the dyad have shared a rivalry for more than 5, years and as 0 otherwise.[60] Information on international rivalries is taken from Goertz, Diehl and Klein`s widely cited International Rivalry dataset, version 5.0 (Goertz, Diehl, and Klein 2006). In this dataset, rivalries are operationalized by looking at the frequency of militarized interstate disputes over time, the issue linkage of different disputes, and the severity and histories of the individual disputes (Goertz, Diehl, and Klein 2006). The expectations that are related to this variable can be expressed in the following hypothesis:

H3a: A shared long lasting rivalry with another state makes allies more likely to design alliances hierarchically

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[60] The five year threshold is an arbitrary and quite generous interpretation of what constitutes a longtime shared rivalry. I have run the variable with different operationalizations, and found no change in results.

The second variable measures whether the states in the dyad have been allied before. If the states have been allied previously and since they are drawing up an alliance at the alliance-decision point, then it is plausible to think that they will expect higher interaction in the future than states who have never been allied before. This variable, *previously allied*$_{ij}$ is defined as a dummy variable, and scored as 1 if the states have been allies previous to the alliance-decision-point, and zero otherwise. It yields the following hypothesis:

H3b: Being previously allied makes allies more likely to design alliances hierarchically

4.5.5 Relational specificity

I will here include four proxies for relational specificity. The first two variables pick up whether the states in the dyad, are directly or indirectly located strategically close to each other, the third variable indicates whether the weaker state is located strategically close to a rival of its partner, the last variable indicates whether or not the stronger state in the dyad has few other allies.

The first three variables are proxies for site specificity, defined by Williamson as "successive stations…that are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses" (1985, 95). This is highlighted by Weber, who claims that allies that are strategically located *or* very close would be particularly vulnerable if the ally were to act opportunistically since "cheating or defecting could leave a big gap in the security system or raise cooperation costs significantly" (Weber 2000, 23-24). The first kind of site specificity measures whether the allies in the dyad are close to each other in the "cheek-by-jowl" sense that is implied by Williamson (1985, 95). This will be modeled by including the variable *contiguity*$_{ij}$. If the two states in the dyad share a land or river border or are contiguous and only separated by 12 miles of water or less, the dyad gets a score of 1 on this variable, and zero otherwise. The second variable, *colonial contiguity*$_{ij}$ measures whether the states have colonial dependencies that are contiguous, or if one or both of the states are contiguous to a colonial dependency belonging to the other state. If there is colonial contiguity, in the sense that one of *j* or *i*`s dependencies shares a land or river border with the other state or with a dependency of the other state, this variable is scored as 1, and zero otherwise. Data on colonial and direct contiguity is generated by the EUgene software, version 3.204 (Bennett and Stam 2000a), using updated Correlates of War data (Sarkees and Wayman 2010). Contiguity and colonial contiguity yields the following two hypotheses:

H4a: Alliance members who are directly contiguous are more likely to design alliances hierarchically

H4b: Alliance members who are indirectly contiguous, via colonial dependencies, are more likely to design alliances hierarchically

The third variable captures the strategic location of the states in the dyad that is not picked up by contiguity *per se*. This variable, *strategic location*$_j$, is scored as 1 if the weaker state in the dyad shares a land or river border with a rival of the stronger partner, and zero otherwise. If state *j* is contiguous with the rival of a state *i*, it means that state *j* represents a strategic asset to state *i* because state *i* can launch attacks from *j*`s territory, and in some cases *j* would have to be defeated before *i* could be attacked. Belgium`s relation to the United Kingdom is a good example of such specificity. Whenever Belgium has been invaded by the European expansionist of the day – The Kaiser, Napoleon or Hitler – the English Channel, and England by implication, has become exposed to attack. *Strategic location*$_j$ will probably also capture some physical specificity, since investment in physically dedicated assets like bases, ports, etc. should be expected to correlate with the degree to which the subordinate state is situated in a particular strategic situation vis à vis a common adversary. This can be exemplified by NATO, where investments in forward US bases made sense because the United States itself was not located close to the expected frontlines, and this increased the degree of physical relational specificity (Lake 1999, 153-154). This variable is computed with data on rivalries from the international rivalry dataset (Goertz, Diehl, and Klein 2006) and data on contiguity from the EUgene software, version 3.204 (Bennett and Stam 2000a), which uses updated Correlates of War data (Sarkees and Wayman 2010). This yields the following hypothesis:

H4c: Alliances where the weaker member shares a border with a rival of the stronger member are more likely to be designed hierarchically

Finally, I have included a variable that proxies a more general form of relational specificity. This variable, *fewer allies*$_i$, measures the number of other allies the stronger party has outside its relationship with *j*. The argument behind this variable is as follows: I assume that a strategic partnership, formalized in an alliance, by itself entails a form of relational specificity, and that changing from one alliance to another is not free of costs. Especially because alliances send a signal of continuity intentions (Morrow 2000), and such signals will lose their credibility if states are constantly switching alliance partners. Therefore, I assume that having a low number of other allies will increase the value of a relationship with an ally one already has. In accordance with the logic of relational specificity, the costs of opportunistic behavior for *i* will decrease with the number of other allies *i* has to lean on if its alliance partner acts opportunistically. If *i* has a low number of other allies, *i* will have incentives to bind the weaker state by establishing hierarchical safeguards. To ease interpretation, especially since I am dealing with interaction terms, this variable is scored as 1 minus the number of other *allies*,[61] meaning that a positive result on this variable is expected to increase the likelihood of hierarchical alliance design, also in interaction with the opportunism, frequency, and non-behavioral uncertainty variables. Data on this variable is found in the ATOP dataset version 3.0 (Leeds et al. 2002). This yields the following hypothesis:

H4d: A low number of other allies for the stronger state makes allies more likely to design alliances hierarchically

To summarize, I have operationalized four variables that are assumed to proxy relational specificity: *Contiguity*$_{ij}$, *colonial contiguity*$_{ij}$, *strategic location*$_{j}$, and *fewer allies*$_{i}$.

4.5.6 Governance Costs

As mentioned above, governance costs occur when state *i* has to compensate, coerce or monitor the subordinate party, or engage in costly forms of self-binding. Simply put, they are the price of establishing a hierarchical governance structure, a price which is assumed to rise with hierarchy. I will here include two variables that should be associated with governance costs for the dominant state.

One plausible source of governance costs is *distance*. The greater the distance between the dominant and the subordinate state, the harder it is for the dominant state to send personnel and equipment to the subordinate, making it harder to monitor the subordinate and to enforce compliance once a hierarchy is established.[62] Distance will then increase the governance costs, making it probable that hierarchical security cooperation will become more likely the closer the subordinate state is to the dominant state.[63] I will define *distance*$_{ij}$ as the

[61] I have chosen to measure the total number of allies instead of alliances, since I expect the number of allies to be more important. I believe that a high number of allies distributed on few alliances (example: 10 allies, 2 alliances) will represent a greater outside option than only a few allies distributed on many alliances (example: 4 allies, 4 alliances). In short, it is the raw number of friends you have that counts, not the number of groups you are part of.

[62] The effect of distance on a state`s ability to project force is famously described in Boulding (1962).

[63] This variable will be correlated with contiguity, but there are good reasons for treating it as a different variable. Contiguity and distance both capture different aspects of the concept of proximity, and especially since

natural logarithm of the kilometer distance between the capitals of the states in the dyad.[64] Information on distance is found by using the EUgene data-generating tool, version 3.204 (Bennett and Stam 2000a).

Since distance is expected to be associated with higher governance costs, and given the relationships outlined above, we get the following hypothesis:

H5a: An increase in distance makes allies less likely to design alliances hierarchically

A second source of governance costs can probably be found in the degree of *interest divergence* of the states in the dyad. If state *j* has interests that are highly convergent with those of state *i*, it is likely that state *i* will need to compensate, coerce or monitor *j* less than it would if it had highly dissimilar interests. I will here operationalize *interest divergence*$_{ij}$ by using Signorino and Ritter`s s-measure directly, as opposed to special calculation used for the computation of *risk attitude*$_j$. As described above, the s-measure indicates the similarity of alliance-portfolios of the states in the dyad. I will here define interest divergence as the divergence of *j* and *i*`s alliance portfolios in the region of the weaker state, measured by s. The assumption here is that interest divergence increases the likelihood that the stronger state will have to engage in self-binding, coerce, compensate or monitor the subordinate. The reason for operationalizing it as *regional* interest similarity is that I assume that the subordinate will put more emphasis on the interest similarity with the stronger state in its relevant region than it will globally. Global interest similarity will be more important for the stronger state, since it will have a stronger global reach (Boulding 1962). To ease interpretation I have reversed the sign on this variable, so that an increase represents an increase in interest divergence. This variable will be lagged by one year to reduce problems of endogeneity.

There are two important caveats to the argument for the inclusion of this variable. First, it should be noted that a certain degree of interest similarity is implied by the very fact that we are studying dyads consisting of states that are already allied, and that states with highly dissimilar interests will be unlikely to ally in the first place. Nevertheless, given the logic of the transaction-cost argument, one would expect to see that the dyads with more divergent interests would be less inclined to opt for hierarchical organization, since this would require high levels of coercion, compensation, monitoring or self-binding from the dominant state.

I am here operationalizing distance as the inter-capital distance. The distance between the capitals of contiguous states may still be great.

[64] I have operationalized this variable using a log-transformation due to the expectation that distance will have a relative, not an absolute effect. In other words, I assume that an increase of 100 kilometers counts less at higher distances, and more at higher distances.

Secondly, it can be argued that regional interest dissimilarity also can serve as a proxy for opportunism by *j*. Nevertheless, I believe it is a much stronger proxy for governance costs. This is because hierarchical governance will entail a greater loss of autonomy for *j beyond* what is required to keep *j* from acting opportunistically, for the simple reason that *i* is also expected to act in an opportunistic fashion. Thus, hierarchical governance *shifts the space for opportunism in i`s favor*, leading *j* to resist *i*`s incursions on its autonomy. This logic yields the following hypothesis:

H5b: High divergence of interests makes alliance members less likely to design alliances hierarchically

4.5.7 Interaction terms

If the transaction-cost theory is accurate, we would expect to find a range of interaction effects between relational specificity and the variables capturing opportunism, frequency, and non-behavioral uncertainty (see figure 3), since the costs of opportunistic behavior and exogenous shocks rise with relational specificity. This is especially true if, as Lake has emphasized, the effect of the other transaction-cost variables are *contingent* on high levels of relational specificity (Lake 1999, 53-54). I will therefore include several interaction terms to model the potential interaction of opportunism, frequency, and non-behavioral uncertainty with relational specificity. These interaction terms will be studied in isolation, and when included together with other variables. For practical reasons, they will not be listed here, but when presenting the results they will simply be represented by the two constituent variables adjoined by the capital letter X.

It is important to note that I am investigating both the effects of the opportunism, frequency and the non-behavioral uncertainty variables independently and in interaction with relational specificity. If being in a military alliance entails a form of diffuse specificity that is harder to model statistically, creating reputational costs and costs of signaling in addition to the sunk costs of conditioning policy on the continued cooperation of an ally, this will make the effects of *any* form of opportunism, and non-behavioral uncertainty push in the direction of hierarchical governance regardless of the values on the specificity variables chosen here. Thus, all of the hypotheses that concern opportunism, frequency, and non-behavioral uncertainty derived above are accompanied by related hypotheses, stating that the same relationship between the variables and hierarchical organization is expected to hold, but that this relationship is conditional on high levels of relational specificity involved.

Table 3 - Data source and operationalizations of the transaction-cost variables

Variable	Operationalization	Expected sign	Data source	Hypothesis
Opportunism				
instability$_j$	*temporal proximity of ± 3 unit change in polity score*	*positive*	*Polity IV (Marshall and Jaggers 2002)*	*H1a*
risk attitude$_j^*$	*special calculation of s-measure*	*positive*	*EUgene v.3.204 (Bennett and Stam 2000a)*	*H1b*
democracy$_j^*$	*>= 6 points on the polity IV scale*	*positive*	*Polity IV (Marshall and Jaggers 2002)*	*H1c*
regime dissimilarity$_{ij}^*$	*polity2 score difference*	*positive*	*Polity IV (Marshall and Jaggers 2002)*	*H1d*
Non-behavioral Uncertainty				
risk-score variance$_{ij}^*$	*yearly variance in combined regional risk score*	*positive*	*EUgene v 3.204 (Bennett and Stam 2000a)*	*H2a*
systemic Capability fluctuation$_{ij}$	*yearly fluctuation in cap. of great powers*	*positive*	*Same as above*	*H2b*
Frequency				
shared rival$_{ij}$	*enduring shared rivalry (>5 years)*	*positive*	*Rivalry dataset (Goertz, Diehl, and Klein 2006)*	*H3a*
previously allied$_{ij}$	*if states in dyad have been allied previously*	*positive*	*ATOP, v.3.0 (Leeds et.al 2002*	*H3b*
Asset-specificity				
contiguity$_{ij}$	*directly shared border*	*positive*	*EUgene v 3.204 (Bennett and Stam 2000a)*	*H4a*
colonial contiguity$_{ij}$	*indirectly shared border*	*positive*	*Same as above*	*H4b*
strategic location$_{ij}$	*j shares a border with the rival of i*	*positive*	*EUgene v 3.204 (Bennett and Stam 2000a), and (Goertz, Diehl, and Klein 2006)*	*H4c*
fewer allies$_i$	*1 - number of other allies*	*negative*	*ATOP, v.2.0 (Leeds et.al 2002)*	*H4d*
Governance costs				
distance$_{ij}$	$log(kilometres)$	*Negative*	*EUgene v.3.204 (Bennett and Stam 2000a),*	*H5a*
interest divergence$_{ij}^*$	*s-measure of similarity*	*Negative*	*EUgene v.3.204 (Bennett and Stam 2000a)*	*H5b*

4.6 Control variables

I will here operationalize a set of control variables that are derived from more conventional explanations in IR theory. These will constitute a *baseline model* which the transaction-cost variables will be compared to. The control variables I present will be grounded in three related explanations that can be linked to the IR traditions of neorealism and dependency theory which were presented in chapter 2.

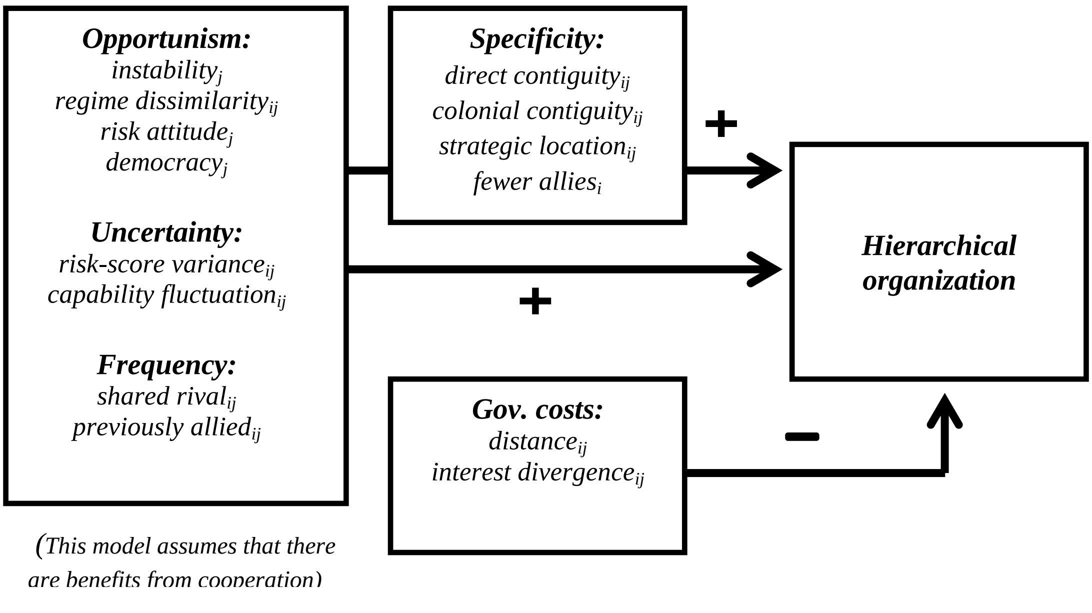
The first explanation is founded on neorealist theory, which implies that states seldom give up control over security-related policy unless they are more or less forced to do so (for an example of this line of thinking, see Mearsheimer (1995, 10-14)) According to this view hierarchical organization is simply a result of the ability of the stronger state to coerce the weaker to accept it. It is important to note that this explanation is not completely incompatible with the transaction-cost argument, especially not with the version of it that is modeled here, where the stronger state is selecting the alliance design. However, the ability of the stronger state to coerce the weaker will be treated as a control variable, since it is not exclusively tied to the transaction-cost argument but is a prediction of mainstream neorealist theory. To test this explanation, I will include a variable that measures the asymmetry in the military power of the states in the dyad, to represent the opportunity for coercion. This variable, *power asymmetry*$_{ij}$, will be defined as the natural logarithm of the capability score of *i* (measured in CINC scores, described in part 4.4) minus the natural logarithm of the capability score of *j*.[65] *Power asymmetry*$_{ij}$ is lagged by one year to reduce problems of endogeneity. The argument for the inclusion of this variable leads us to expect that greater power asymmetries will increase the likelihood of hierarchical alliance design. As a supplement to *power asymmetry*$_{ij}$, I will include a variable measuring the absolute size of the weaker state. As Hegre (2008) has shown, variables for size should be included to estimate the effect of power asymmetry correctly. I will therefore define the variable *size*$_{ij}$, measuring the log of the total population of the smallest state in the dyad. Based on the argument from asymmetry, and the noted relationship between asymmetry and absolute size, we expect that a smaller weaker state will increase the likelihood of hierarchical alliance-design. Information on population is taken from the National Material Capabilities dataset (Sarkees and Wayman 2010), version 4.0 (COW 2010).

The second explanation is also related to neorealism, but rather than emphasizing the coercion of the weaker by the stronger, it focuses on the threat from third parties and claims that hierarchical organization is a function of the need for military capacity building vis à vis external threats. This argument is made by Weber (2000, 20), and she includes it as a variable

[65] I use natural logarithms because power asymmetries should reflect a relative, not an absolute quantity. The formula used is $ln(CINC_i) - ln(CINC_j)$

to supplement the transaction-cost variables. To control for this possibility, I will define the variable $threat_{ij}$ as the logarithm of the combined CINC scores of all states that are in an international rivalry with *i* and *j* in the year prior to the alliance decision. I will also define two variables for the threat level of each state $threat_i$ and $threat_j$ to see which variable has the biggest impact. Information on international rivalries is taken from Goertz, Diehl, and Klein`s (2006) international rivalry dataset. As another proxy for the military expediency of hierarchical organization, I will include a variable measuring whether or not the alliance was created in wartime. I expect this to be a supplementary indicator of the level of military threat facing the states in the dyad, and, more generally, of the military *urgency* of the need for security cooperation.[66] This variable, $wartime_{ij}$, is scored as 1 if any of the members participated in a war at the alliance-decision point according to the Correlates of War data on interstate war (Sarkees and Wayman 2010).

Figure 4 - The transaction-cost model of alliance design (with proxy variables)



The third explanation is rooted in dependency theory (Cardozo and Faletto 1979), world-systems theory (Wallerstein 1974) and structural theories of imperialism (Galtung 1971), and it claims that hierarchical alliance structures are a continuation of imperialist exploitation of the periphery by the "core" states. As noted in chapter 2, dependency theory postulates that hierarchical relations in reality are exploitative relationships in which states in the "core"

[66] The intuition here is that a wartime situation produces a greater need for military capacity building than peacetime situations.

exploit states in the periphery. To model such exploitation I have chosen to include a control variable that measures the degree to which state *i* has previously been in a colonial relationship with state *j*. If modern day security arrangements and dominance relations are continuations of old-fashioned imperialism, as is implied in views like Galtung`s (1971, 92), and if core-periphery structures are as robust as is proposed by theorists in this tradition, then it would follow that a previous record of domination will be associated with a higher likelihood of hierarchy. I have therefore created the variable *colonial history*$_{ij}$ which is a dummy variable, measuring whether or not *j* has been a colonial dependency of *i* at some point prior to the alliance-decision point (1=colonial dependency, 0=not colonial dependency). Data on this variable is taken from the Issue Correlates of War project`s Colonial history dataset, version 0.4 (Hensel 2006). Note that this variable is not totally incompatible with the transaction-cost theory either. The reason for this is that it might pick up the instrumental similarity between colonial domination, and hierarchical military alliances, a similarity which is implied by the anarchy-hierarchy continuum – drawn up in chapter 2.

4.7 Statistical model

It is important to choose a statistical estimator that is appropriate for the variables chosen and for the theoretical relationships being postulated (Achen 2002). As mentioned above, my dependent variable is a dummy variable, measuring a discrete choice, namely whether or not the countries in the bilateral alliance have opted for a hierarchical (Y=1) or non-hierarchical alliance design (Y=0). Even if hierarchy is here conceptualized as an underlying variable spanning a range of various degrees of political authority, we can only measure how this variable is expressed in the thresholds that make up the concrete choices of alliance design. Since our variable is dichotomous, we cannot assume that the relationship between the variables is continuous and linear (since there are no values outside the boundaries of 0 and 1), nor that the error term is normally distributed. In this case, it would make sense to use a logistic regression model that can tell us how the *log odds* (the "logit") of hierarchical alliance design, Y, changes with changes in the independent variables (Glasgow and Alvarez 2008).[67] The basic logit model can be specified as:

$$\ln\left(\frac{p_Y}{1-p_Y}\right) = b_0 + b_1X_1 + \cdots + b_nX_n$$

[67]Another option here is to use a probit model. However, there is almost never a great substantive difference in practice between a binary logistic model and a probit model (Glasgow and Alvarez 2008, 516).

Where b_0 is an intercept and b_1-b_n are slope coefficients for the variables X_1-X_n. This leads to the following model for estimation (without interaction terms):

$$\begin{aligned}\ln\left(\frac{p_y}{1-p_y}\right) = \beta_0 &+ \beta_1 instability_j + \beta_2 risk\ attitude_j + \beta_3 regime\ dissimilarity_{ij} + \beta_4 democracy_j \\ &+ \beta_5 capability\ fluctuation_{ij} + \beta_6 risk\ score\ variance_{ij} + \beta_7 shared\ rival_{ij} \\ &+ \beta_8 previosly\ allied_{ij} + \beta_9 contiguity_{ij} + \beta_{10} strategic\ location_{ij} \\ &+ \beta_{11} colonial\ contiguity_{ij} + \beta_{12} fewer\ allies_i + \beta_{13} distane_{ij} \\ &+ \beta_{14} interest\ divergence_{ij} + \beta_{15} power\ asymmetry_{ij}) + \beta_{16} size_j) \\ &+ \beta_{17} colonial\ history_{ij} + \beta_{18} wartime_{ij} + \beta_{19} threat_{ij} + \varepsilon_{ij}\end{aligned}$$

(interaction terms are left out, for practical reasons)

In addition to the independent variables and their coefficients, the model includes ε_{ij} which is an error term. This model will be *significantly* reduced as the statistical analysis proceeds and irrelevant variables are excluded from the model, and it is not the purpose of my analysis to estimate the entire model with all the variables included simultaneously.

Table 4 - Descriptive statistics for main variables

Variable	Mean	Std.dev	Skewness	Kurtosis
hierarchy	0.260	0.440	1.090	2.189
instabiity$_j$	0.741	0.271	-0.756	2.313
risk attitude$_j$	-0.478	0.493	1.312	3.955
regime dissimilarity$_j$	5.818	6.240	0.951	2.563
democracy$_j$	0.109	0.312	2.507	7.289
risk-score variance$_{ij}$	0.380	0.126	0.130	2.860
capability fluctuation$_{ij}$	17.957	6.516	0.754	3.813
previously allied$_{ij}$	0.284	0.452	0.953	1.908
shared rival$_{ij}$	0.206	0.405	0.448	3.097
contiguity$_{ij}$	0.448	0.498	0.207	1.042
strategic location$_{ij}$	0.436	0.497	0.256	1.065
colonial contiguity$_{ij}$	0.115	0.320	2.411	6.814
fewer allies$_i$	-12.254	12.928	-1.330	3.904
distance$_{ij}$	7.259	1.029	0.250	2.555
interest divergence$_{ij}$	-0.583	0.442	0.984	3.542

4.8 Missing values

I will here give a brief account of how I have handled missing values, since the analysis is based on data where some missing values have been replaced.[68] I will replace missing values for a small number of variables where this is appropriate.

I have chosen to replace missing values if the missing value is due to a lag in the variable, or if it is due to a missing value for a certain year in a time-series and a value from a year that is close to the missing year is available (maximum ± 2 years, and previous years are given priority to reduce endogeneity), *and* given that the variable is known to change very slowly from year to year (a necessary conditional). An example of this would be the CINC scores, which change quite slowly over time. This procedure is admittedly ad hoc, but it is based on reasonable assumptions that I think will contain the danger of the kind of "absurd" results that many ad hoc replacement methods are known to generate (Honaker and King 2010, 562). Even though the procedure comes at the price of some added potential endogeneity, the gains in variance and reduced measurement error justifies this adjustment.

An overview of missing values where this is relevant is available in the appendix. I have also corrected missing values that are due to coding errors arising from differences between datasets in the country codes for some countries.[69] Using listwise deletion, there are around 43 cases that are left out of the coming analyses. The threats posed by missing values are often hard to assess since we lack information about the missing observations. Nevertheless, I will here conclude that they are acceptable and that I have enough data to run the analysis.

4.9 Summary

Above, I have presented a research design that enables us to test the transaction-cost argument on the subject of alliance design quantitatively (see table 3). First, I have operationalized factors that might generate opportunistic behavior by including variables measuring the political instability, and the risk attitude of the weaker state, its institutional dissimilarity from the stronger state and whether or not it is democratic. Secondly, I have operationalized non-behavioral uncertainty by including an indicator of measuring the fluctuations in the capabilities of the great powers, and by including an indicator of the variation in risk attitudes

[68] It is important to keep in mind that many of the variables are computed on the basis of two states for each dyad, so that the total number of cells in those cases is 208x2.

[69] The Polity IV dataset, the Correlates of War dataset and the ATOP dataset differ in treating some countries as the same *state* and two different states. The following countries are coded differently in different datasets, and have been collapsed into one state in my analysis: Austria-Hungary and Austria, Russia and the Soviet Union, The Czech Republic, Slovakia and Czechoslovakia during the Cold War, and Pakistan and the Islamic Republic of Pakistan.

in the relevant international environment of the states in the dyad. Thirdly, I have included proxies for the expected frequency of interaction by looking at whether or not *i* and *j* share a long-time rival, and whether or not they have been allies before. Fourthly, I have included proxies for relational specificity, by using indicators that capture whether or not *i* and *j* are directly or indirectly contiguous, whether or not *j* is strategically located close to a rival of *i*, and whether or not *i* has many other allies to rely on if *j* were to defect, cheat or entrap *i* in an unwanted conflict. Finally, I have included the distance between *i* and *j*, and their interest divergence as proxies for the governance costs entailed by *j* having to engage in costly self-binding, or by having to monitor, coerce, or compensate the weaker state. In addition to this I have chosen control variables from conventional IR theory that will constitute a baseline model with which to compare the explanatory power of the transaction-cost model. These variables capture the opportunity for coercion by the stronger state, the need for military capacity building, and the possible colonial exploitation of the weaker state.

If the transaction-cost theory of international security cooperation offers a powerful explanation, many of these variables should have significant explanatory power when applied to the design of military alliances, and it should constitute an explanatory improvement on a model that only includes the successful variables from the basic control model.

5. Results

In this chapter, I will present the results of the logistic regression analyses. I find that the risk-attitude of the weaker state, regime-dissimilarity, indirect contiguity, colonial history and asymmetries in size and power are significantly associated with hierarchical alliance-design, while many of the other transaction-cost variables fail to perform in the expected way.

5.1 The logic of the empirical analysis

In the following I will do three things. I will discard or confirm hypotheses derived from the transaction-cost model (chapter 4). I will also evaluate the relative strength of the successful variables from the transaction-cost model when compared to the successful variables from the baseline model. Since this is the first test of the correlates of hierarchical alliance design, exploratory analysis that tells us which variables are important regardless of the overall performance of the theoretical model will serve a purpose. I will therefore also identify a model that maximizes explanatory power, with the smallest number of variables. I am here following Hosmer and Lemenshow`s plea to identify the "most parsimonious model that best explains the data" (2000, 92). This inductive approach will then serve as a supplement to the deductive exercise of testing the hypotheses, and it will provide us with a model of explanatory variables that can be used in future research.

More specifically I have structured my analysis as follows. First, I have followed the suggestions of (Hosmer and Lemeshow 2000, 92-97) and started with a univariate logistic test of each independent variable`s effect on hierarchy in isolation. This is done to identify variables that are not even candidates for statistical significance, and that should not be included in a full model. The reason for excluding variables in this way is that including irrelevant variables reduces the efficiency of the estimates by inflating the standard errors (Menard 2010, 116), and it may lead to unstable coefficient estimates (Hosmer and Lemeshow 2000, 92). This problem is particularly acute given the high number of variables I have included in my analysis. I have followed Hosmer and Lemenshow`s suggestion (2000, 93-95), and excluded variables that have a p-value of $>.25$. This threshold is partly arbitrary, but, as Hosmer and Lemenshow argue, a more conservative significance level might exclude variables that turn out to be important in the presence of other variables (2000, 95). I have followed the same procedure for each interaction term, but these regressions are not univariate, since I have had to include the component variables of each interaction effect.[70] This is to prevent that the interaction effects pick up the omitted-variable bias that can be produced by excluded constituent terms. This procedure leads me to a model of relevant variables that all count as candidates for statistical significance.

In step two, I have retested the performance of each variable and interaction term that was excluded in step one by including them individually in the model of relevant variables. This is done to see if I have excluded any variables that only reach statistical significance in the presence of other variables that are relevant. This is a precaution against "suppressor effects" (Menard 2010, 117), and omitted-variable bias, that make variables significant only when other variables are controlled for. This leads me to a revised model with all relevant variables included (the full model, and the full model with interaction terms in table 5).

In step three, I have followed a procedure of "stepwise backwards elimination" (Hosmer and Lemeshow 2000, 116) where I first estimate a full model with the variables deemed relevant in the previous analyses, exclude the variable in this model with the highest p-value, then estimate a new model, and perform the procedure again until the only variables that are left are those that make a significant contribution to the model. This was done using the likelihood-ratio test-statistic. This procedure leads me to an *efficient model* that maximizes efficiency and explanatory power.

Finally I have evaluated whether or not the successful variables from the transaction-cost model do a better job at explaining the data than the successful variables from the control model. In this section I have also compared the out-of-sample predictive performance of the successful transaction-cost variables to that of the baseline model of control variables.

Results from the first tests for relevance, both for the individual variables and for the interaction terms are placed in the appendix for practical reasons (table 10-13).[71] In table 5 below I present four models: The baseline model of relevant control variables, the full model of individual variables including only the variables that pass the relevance tests, the full model with significant interaction terms, and the efficient model I reached by backward elimination. The estimates in table 5 (and in table 7) are presented as raw logit estimates. These quantities are fairly unintuitive, and it is hard to say something about the substantial effects from those tables. Therefore I will give the important results a more intuitive

[70] The threshold for inclusion for interaction terms in the full model in table 5 is $p < .05$. This is because interaction terms produce greater inefficiency, since we have to include constituent terms for each interaction term (meaning that each interaction term automatically implies the inclusion of two more variables). This does not endanger the inferences drawn, because the variables have been tested in the full model (table 13).

[71] The stata code for the backward elimination procedure is placed in the appendix (appendix 2).

presentation in table 6, where I will use King, Tomz and Wittenberg`s CLARIFY software (King, Tomz, and Wittenberg 2000) to present predicted probabilities for the variables that perform well.[72]

5.2 Presentation of results

I will here present the results, proceeding by the variable categories that the estimates belong to. For each of the opportunism-, frequency-, and non-behavioral uncertainty variables, I have tested their interaction effects with the specificity variables, in addition to testing their independent effects on alliance design.

5.2.1 The control variables

In the following, I will identify a proper baseline model that only includes control variables that pass all tests for relevance and that contribute significantly to the model. *Power asymmetry*$_{ij}$ passes the univariate tests, and has the expected sign in all models, but it is not statistically significant in the full model. As Hegre (2008) has pointed out, relative power asymmetry and the *absolute* size of the states in the dyad are usually highly correlated, and much of its reduction seems to be due to the fact that the absolute size of the weaker state, *size*$_j$, picks up some of this effect. Because of their high correlation, *size*$_j$ and *power asymmetry*$_{ij}$ can be seen partly as proxies for each other.[73] *Size*$_j$ is both statistically and substantially significant, and in the expected direction in the full models and the efficient model. It tells us that smaller subordinate states are more likely to end up with hierarchically designed military alliances. Results from table 6 show that an increase in *size*$_j$, from its mean (19 million inhabitants) to its maximum value (567 million inhabitants), when all other variables are kept at their means, decreases the probability of hierarchical design by 13%. This result is a partial implication of the argument that hierarchical alliance design is a product of the capacity of the stronger state to coerce the weaker.

[72] CLARIFY is a widely used tool when it comes to presenting results in the quantitative political science literature. It uses statistical simulation algorithms to simulate the parameters in the logistic regression model, so that we can present quantities of interests, like the percentage increase in Y given that the value of X1 is at the 75th percentile and all other X`s are held at their means, and the uncertainty of this estimate. Since logit estimates are can be hard to interpret in a straightforward and intuitive way, this tool is very useful for presenting the results of a logistic regression. For more information on CLARIFY, see King, Tomz and Wittenberg (2000). The software can be downloaded at http://gking.harvard.edu/home
[73] In the efficient model, power asymmetry is left out, but size can in many ways be seen as a proxy for power asymmetry. In the comparative evaluation of the successful control variables and the successful transaction-cost variables, power asymmetry is included.

Table 5 - Logistic regression of the determinants of alliance design

	Baseline model	Full model	Full model with interaction terms	Efficient model
Opportunism				
instability$_j$	---	-.011 (0.01)	-.085 (-0.07)	---
risk attitude$_j$	---	2.188*(3.13)	2.502* (3.28)	1.836* (3.38)
regime dissimilarity$_{ij}$	---	.080$^+$ (1.68)	.114*(2.20)	.118* (2.47)
Uncertainty				
risk-score variance$_{ij}$	---	-.880 (-0.36)	.184 (0.05)	---
capability fluctuation$_{ij}$	---	-.050 (-1.05)	-.150* (-2.01)	-.130$^+$ (-1.93)
Frequency				
previously allied$_{ij}$	---	.811 (1.03)	0.484 (0.61)	---
Specificity				
contiguity$_{ij}$	---	-.178 (-0.27)	-3.764$^+$ (-1.96)	-3.083$^+$ (-1.91)
strategic location$_{ij}$	---	-.065 (-0.17)	-.212 (-0.11)	---
colonial contiguity$_{ij}$	---	3.023* (2.97)	3.418* (2.98)	3.317* (3.27)
fewer allies$_i$	---	-.062* (-2.24)	-.058* (-2.24)	-.052* (-2.56)
Governance costs				
distance$_{ij}$	---	-.515 (-1.22)	-.708 (-1.58)	---
interest divergence$_{ij}$	---	1.538$^+$ (1.81)	1.314 (1.53)	---
Controls				
power asymmetry$_{ij}$	.378* (2.87)	.061 (0.22)	.158 (0.57)	---
colonial history$_{ij}$	1.384* (2.76)	1.663*(2.18)	1.080 (1.39)	1.243* (2.07)
size$_j$	-.170 (-0.90)	-.926* (2.54)	-.872*(-2.34)	-.801* (-3.21)
Interaction				
capability fluct$_{ij}$ *X contiguity*$_{ij}$	---	---	.206*(2.02)	.187* (2.07)
N	165	165	165	165
Pseudo R^2	.21	.49	.47	.46
Log likelihood	-75.03	-50.37	-48.18	-50.73
% correctly classified^X	76.47%	85.45%	86.06%	81.87%

*z-statistics are in parenthesis, * = significance level of 5%, $^+$ = significance level of 10%, ^{X}= correctly predicted when probability threshold is .5, these models only includes variables that passed the initial tests for relevance, results are presented as logits*

The threat variables and *wartime*$_{ij}$ perform worse than expected. Rather surprisingly neither *threat*$_i$, *threat*$_j$, nor the total threat level, *threat*$_{ij}$, passes the univariate tests (appendix, table

10). This indicates that the total external threat level does not affect the choice of hierarchical alliance design. The $wartime_{ij}$ variable is insignificant in both the univariate test, and when included in the model with relevant variables (appendix ,table 12). This indicates that states who are engaged in a war at the alliance-decision point are no more likely to opt for hierarchical organization. These results weaken the explanation that hierarchical design is related to the need for military capacity building. Hierarchical organization does not seem to depend on the threat from a third party.

Colonial history$_{ij}$ passes the univariate test and is both substantially and statistically significant in the full and the efficient model (table 5). The results from table 6 show that having a colonial history, when all other variables are kept at their means, increases the probability of hierarchical alliance design by 17%. These results lead me to a basic control model that includes $size_j$ and *colonial history*$_{ij}$.

5.2.2 Opportunism

The results for the variables relating to behavioral opportunism are mixed.

$Instability_j$ passes the univariate test (appendix, table 10), but it does not reach statistical significance in the full model (table 5). When I test for interaction with the asset-specificity variables the expected result does not appear either. Its interaction with specificity is not significant (appendix, table 11). This should lead us to discard the hypothesis *H1a,* which states that political instability in the weaker state will make hierarchical design more likely.

Risk attitude$_j$ shows an expected result. It is statistically and substantially significant in all the models and it has the expected sign (table 5). The results show that an increase in risk attitude from its mean to its maximum value, when all other variables in the efficient model are kept at their means, increases the probability of hierarchical organization by 54% (table 6). This is a substantial increase, and it lends support to the hypothesis *H1b,* that risk acceptant weaker states make hierarchical design more likely. However, and in opposition to the theoretical expectations, risk attitude does not interact in the expected way with the variables for relational specificity. Fears of entrapment and risk-seeking weaker allies seems to be independent reasons for hierarchical design.

The results for $democracy_j$ are not as expected. It does not pass the relevance tests independently (appendix, table 10). When I test its interaction with the specificity variables it only interacts significantly and in the expected direction with $contiguity_{ij}$ (appendix, table 11), a result which is insignificant when included in the full model (appendix, table 13). This should lead us to discard the hypothesis that democracy in the weaker state makes hierarchical organization more likely (*H1c),* and its opposite *(H1d).* It seems that democracy in the weaker state has *no independent effect whatsoever* on the choice of alliance design, even when there is relational specificity.

Regime dissimilarity$_{ij}$ passes the relevance test, is statistically significant, and has a substantial effect on the likelihood of hierarchical design. The results show that an increase in regime dissimilarity from its mean to its maximum value, when all other variables are held at their means, increases the probability of hierarchical alliance-design by 34% (table 6). This lends support to the hypothesis *H2d;* that dissimilar regimes are more likely to choose a hierarchical alliance design. The interaction of regime dissimilarity and relational specificity does not have a significant effect on the choice of alliance design, showing that the effects of regime-dissimilarity do not depend on the specificity conditions modeled here (table 11 and 13).

Table 6 - Change in probability when each variable increases from its mean to its maximum value

X	Max value of X	Change in probability of hierarchical design*
risk attitude$_j$	.98	54%
regime dissimilarity$_{ij}$	20	34%
capability fluctuation$_{ij}$	36.43	-12%
contiguity$_{ij}$	1	-11%
colonial contiguity$_{ij}$	1	59%
fewer allies$_i$	0	-14%
colonial history$_{ij}$	1	17%
size$_j$	12.07	-13%
cap.fluct$_{ij}$ X contiguity$_{ij}$	36.43	73%

*Probabilities were computed using CLARIFY (King, Tomz and Wittenberg 2000), * = The change in probability of hierarchical alliance design when the independent variable is increased from its mean to its maximum value while all other independent variables are kept at their means.*

5.2.3 Non-behavioral uncertainty

The variables for non-behavioral uncertainty perform counter to the theoretical expectations. Both *capability fluctuation$_{ij}$* and *risk-score variance$_{ij}$* are included in the full model, but both variables have the wrong sign (table 5). This leads me to reject the hypotheses, *H2a* and *H2b.* Neither Bueno de Mesquita and Lalman`s (1992) measure of uncertainty, nor the power fluctuation measure increase the likelihood of hierarchical alliance design. When I test for the interaction between uncertainty and relational specificity I find little support for the transaction-cost argument. The only interaction term that is significant when included in the full model is the interaction between *capability fluctuation*$_{ij}$ and *contiguity*$_{ij}$. There is a reason for being skeptical of this particular result: Since contiguity is a geographic variable and uncertainty is heavily time-specific - measuring the global capability fluctuation of the great powers from year to year (see chapter 4) - this makes the combination of these two variables particularly sensitive to idiosyncratic events in a region in a certain time period, and this seems to be the case here; inspection of the results indicate that the effect depends heavily on the alliances the Soviet Union constructed with the Baltic states in 1939. This is an argument for paying less attention to this result when evaluating the relative performance of the transaction-cost variables.

5.2.4 Frequency

The results for the variables capturing the frequency of interaction between *i* and *j* are not supportive of the transaction-cost theory. *Shared rival*$_{ij}$ is not significant in any of the analyses (appendix, table 10, and 12), leading me to reject the hypothesis *H3a,* that a shared long lasting rivalry makes hierarchical alliance design more likely.

Previous alliance$_{ij}$ passes the univariate test, but it is insignificant in the full model (table 5) and has the opposite sign of what we would expect. This suggests that we reject the hypothesis *H3b.* Being previously allied does not make states more likely to opt for hierarchical alliance design. None of the variables for frequency interact significantly with relational specificity (appendix, table 11 and 13).

5.2.5 Relational specificity

In addition to testing the interaction between asset-specificity and the variables that are expected to push in the direction of hierarchical organization (opportunism, frequency and non-behavioral uncertainty), I have tested the independent performance of the asset-specificity variables.

Contiguity$_{ij}$ is significant, although only at the 10% level, in the efficient model, and in the full models. However, it does not have the expected sign, and this leads me to reject hypothesis *H4a.* States who are contiguous are not more likely to organize alliances hierarchically. *Colonial contiguity*$_{ij}$ on the other hand, is both statistically and substantially significant, and in the expected direction in all the tests. The results in table 6 show that *colonial contiguity$_{ij}$,* when all other variables are held at their means, increases the probability of hierarchy by 59%. This lends support to the hypothesis, *H4b,* that colonial contiguity makes hierarchy more likely.

Strategic location$_{ij}$ is not significant in the full models, leading me to reject the hypothesis *H4c*. Alliances where one of the members share a border with a rival of the other member are not more likely to be designed hierarchically.

Finally, *fewer allies$_i$*, proxying the number of outside options the stronger state can rely on in case the weaker state defects, is significant but not in the expected direction in the full models. This disconfirms hypothesis *H4d*, and it shows the opposite pattern: Fewer outside options actually make hierarchical alliance design *less* likely, which contradicts the argument from relational specificity.

5.2.6 Governance costs

The results for the governance-cost variables are not encouraging for the transaction-cost theory. *Interest divergence$_{ij}$* passes the univariate test (appendix, table 10), but is insignificant in the full model (table 5). These results lead me to reject the hypothesis *H5b*, and I conclude that high divergence of interests, measured as the s-score of the states in the dyad, does not make hierarchical organization more likely. *Distance$_{ij}$* passes the univariate test, but it does not reach statistical significance in the full model. This disconfirms the hypothesis *H5a*, and shows that states that are close to each other are not more likely to organize their alliances hierarchically than other states.

5.2.7 Summary of results

To summarize, I find that most of the hypotheses derived from the transaction-cost argument are rejected. Meanwhile I find that the control variables *size*$_j$ and *colonial history$_{ij}$,* to some degree *power asymmetry$_{ij}$,* and the transaction-cost variables *risk-attitude$_j$, regime-dissimilarity$_{ij}$,* and *colonial contiguity$_{ij}$*, are significant and substantially important. *Capability fluctuation X contiguity* is also successful, but as mentioned, there is reason to be somewhat skeptical of this result.

5.3 Overall model performance

Since my analysis both aims to serve a hypothesis-testing purpose and as a model-building exercise, I will here evaluate the explanatory power of the efficient model, that has been identified by backward elimination, compared to the full model, and compare the performance of the successful transaction-cost variables with the performance of the variables from the baseline model. I will also investigate how well these variables predict out of sample by doing a predictive ROC analysis, the details of which will be explained below.

5.3.1 Comparing explanatory power

It is clear from table 5 that the overall performance of the variables in the efficient model is almost as good as that of the full models, and that the model generally does a pretty good job of accounting for the data. The drop in log-likelihood and pseudo R^2 from the efficient model to the full models is very slight. We also see that the percentage of "correctly classified" cases, meaning the number of outcomes that are correctly predicted by the model, classified as predicted if the estimated probability of hierarchy is above a threshold of .5, for the efficient model is very close to the full models. This suggests that the efficient model in table 5 currently represents the best and most efficient model for accounting for the data.

Table 7 - Comparative performance of successful transaction-cost variables

Variable	**Baseline model**	**Transaction-cost model**	**Combined**
risk attitude$_j$	---	1.269*	2.084*
regime dissimilarity$_{ij}$	---	.132*	.112*
colonial contiguity$_{ij}$	---	1.532*	2.123*
size$_j$	-.169	---	-.580*
power asymmetry$_{ij}$	.378*	---	.290$^+$
colonial history$_{ij}$	1.384*	---	1.472*
Log likelihood	-75.03	-74.74	-56.75
Pseudo R^2	.2073	.2104	.4003
% correctly classified^x	79%	79%	84.85%
N	165	165	165

*z-statistics in parenthesis, *= 5% significance level, $^+$=10% significance level, results are presented as logits,*
^{X}= correctly predicted when probability threshold is .5

In table 6, I compare the explanatory power of the successful transaction-cost variables with the successful variables in the baseline model. The results show that the performance of the successful transaction-cost variables is very similar to the performance of the three most successful variables in the baseline model. The two models have very similar pseudo R^2 statistics, and both correctly classify around 80% of the cases. The explanatory power of the combined model is quite high, and this shows that the successful transaction-cost variables offer an improvement on the baseline model.

Both the successful transaction-cost variables, and the variables in the baseline model have a great substantial effect on the probability of hierarchical alliance-design.

5.3.2 Comparing predictive performance

Identifying variables that are statistically significant is not the same as identifying variables that have great predictive power. A lack of attention to predictive power has been a sore spot for quantitative political science for a long time (Beck, King, and Zeng 2000; Ward, Greenhill, and Bakke 2010). As Ward, Greenhill, and Bakke (2010) have argued, the model one has estimated might simply describe the idiosyncrasies and fine nuances of the data structure in the dataset of cases one has estimated it on, without it being able to predict cases that are not in this dataset. If this is the case we have gained more knowledge of that particular dataset than we have about the fundamental causal relationships we are investigating. This is because statistical significance says something about the likelihood of finding a relationship in a randomly drawn sample, while the datasets that are used in IR are often not randomly drawn from a universe of cases, but *constitute* that universe of cases. Testing the predictive power of variables, and especially out of sample, gives us a clue about the predictive accuracy of the models we are using, and I will follow the plea of Ward, Greenhill, and Bakke (2010) by incorporating predictive testing as a part of my analysis. This analysis is necessitated by the novelty of this analysis, and the prospect that the results found here might be used in future research.

To test the out-of-sample predictive power of the variables I will use two of the most common tools for prediction in social science, namely classification tables and ROC curves. A classification table tells us how many of the outcomes on our dependent variable is predicted by the estimated model, given a predefined probability threshold (Hosmer and Lemeshow 2000, 156-157). The classification-table tells us how many positive outcomes we have predicted correctly (true positives), how many negatives we have predicted correctly (true negatives), how many cases we have wrongly predicted to be positive (false positives), and how many cases we have wrongly predicted to be negative (false negatives) (Hosmer and Lemeshow 2000, 156-159). The greater the proportion of true positives to false positives, the greater the predictive power of the model. When the probability threshold is set at a low level, we will predict many correct cases of hierarchical design (many *true positives*), but also wrongly classify many non-hierarchical alliances as hierarchical (many *false positives*), while higher thresholds pull in the opposite direction. The ROC curve is a curve that plots the rate of true positives against the rate of false positives for all possible cutoff thresholds, and the *area under the ROC curve* (the AUC) is a good indication of the predictive power of a model. A model that predicts 100% of the cases of hierarchical design without falsely predicting any cases (false positives) for all possible probability thresholds would be a perfectly accurate predictive model with an AUC score of 1.0. An perfectly inaccurate model, that would get just as many cases wrong as it got right for each possible threshold would get a minimum score of 0.5 (Ward, Greenhill, and Bakke 2010, 366-367).

Testing the models performance outside of the sample it has been estimated on is crucial to see whether the models performance depends on idiosyncrasies of the dataset at hand. Since I do not have data outside my sample in the traditional sense, as there are no cases I have data on outside the ATOP dataset – as is common in most conflict research – I will follow (Ward, Greenhill, and Bakke 2010) and use the technique of K-fold cross-validation, which is a second-best alternative that tests the out-of sample predictive properties of my variables. To perform this test, I have taken the following steps: First, I have split the dataset randomly into 4 equally large subsets. Then I have re-estimated the model on ¾ of the data and tested the predictive performance on the remaining ¼ of the dataset that has not been used for estimating the model. For each random split, this has been done 4 times with different combinations of subsamples being used for estimation and prediction. This cross validation procedure has then been done 10 times with different randomly split subsets (for each model) to minimize the influence of particular parts of the data.[74]

The results listed in table 8 are averages from all these prediction tests. This tells us something about how sensitive the predictive power of the model is to *specific* features of the dataset I have used, and it is a good first indication of the out-of-sample predictive qualities of these variables. In table 8 we see the out-of-sample predictive performance of the model with only the successful transaction-cost variables included, the baseline model, and of the efficient model from table 5. These results show that both the model with the successful

[74] This procedure is described in detail in Efron 1983. It shares the properties of what we normally would view as proper out-of sample testing (testing on future observations or data not being used *at all* for estimation) in that it tests how well the variables perform when they are used to predict data that has not been used for estimation *for each random split*.

transaction-cost variables and the baseline model are quite even, and both have predictive power out of sample.

Table 8 - Out-of-sample predictive power

Variables included	% Correctly predicted positive outcomes*	% False positives*	Area under ROC curve
A: *risk attitude$_j$, regime dissimilarity$_{ij}$, colonial contiguity$_{ij}$*	38%	6%	.78
B: *size$_j$, power asymmetry$_{ij}$, colonial history$_{ij}$*	36%	7%	.77
C: *efficient model*	58%	9%	.88

*results from 4x10 iterations of the out-of-sample predictive procedure, *=probability threshold of .5*

In figure 5 and 6, we see the ROC curves for the in-sample predictive power of the successful transaction-cost variables and the baseline model. As we can see, both offer substantial power when it comes to classifying cases correctly.

Figure 5 - In-sample predictive performance of risk attitude, regime dissimilarity, and colonial contiguity

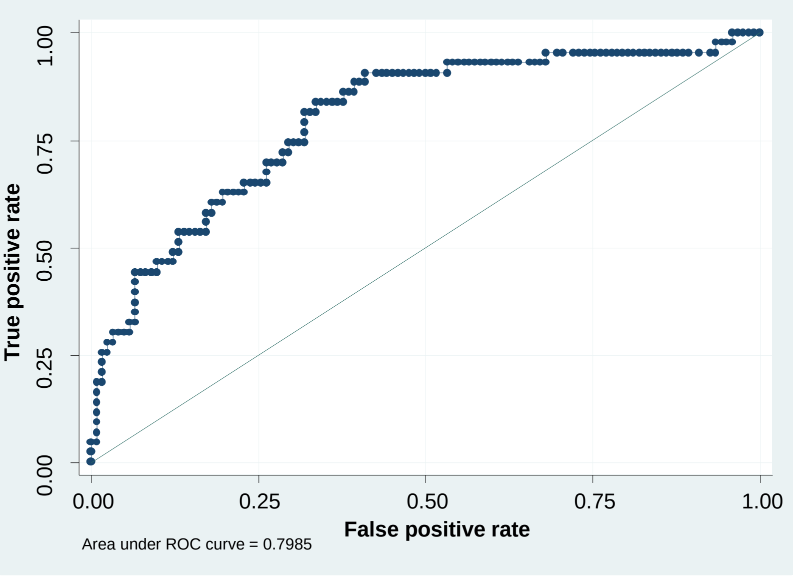
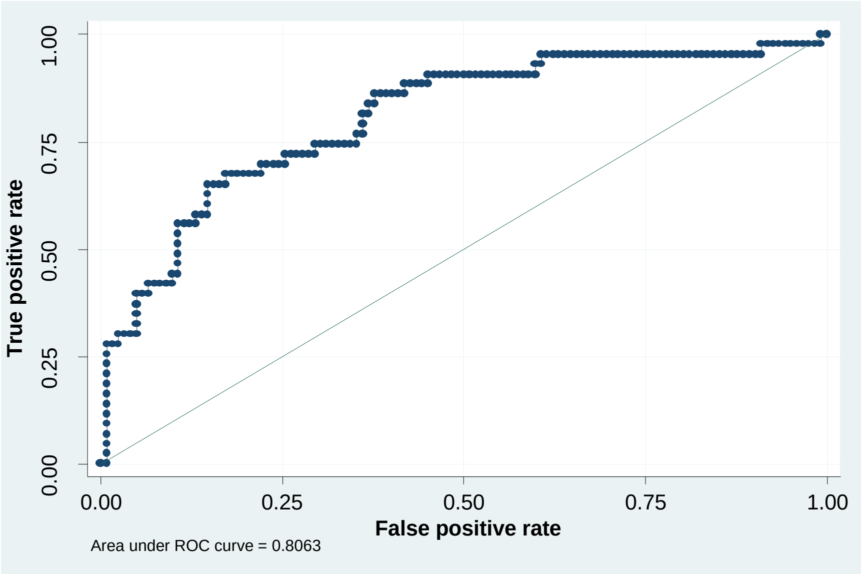


Figure 6 - In-sample predictive power of size, colonial history and power asymmetry



5.4 Summary

There are two distinctive patterns in the results above. First, most of the variables I have operationalized to test the transaction-cost model do not survive the statistical tests performed above. These variables include *instability*$_j$, *democracy*$_j$, *risk-score variance*$_{ij}$, *previously allied*$_{ij}$, *shared rival*$_{ij}$, *strategic location*$_{ij}$, *distance*$_{ij}$, and *interest divergence*$_{ij}$. Of the control variables, the variables related to the need for military capacity building seem the least relevant. Neither *threat*$_j$, *threat*$_i$, *threat*$_{ij}$, nor *wartime*$_{ij}$ are statistically significant.

The variables that seem to be associated with hierarchical alliance design and that have the expected signs are *risk attitude*$_j$, *regime dissimilarity*$_{ij}$, *colonial contiguity*$_{ij}$, the interaction term *capability fluctuation*$_{ij}$ *X contiguity*$_{ij}$, and the control variables *colonial history*$_{ij}$, *size*$_j$, and *power asymmetry*$_{ij}$. Furthermore, *fewer allies*$_i$ is statistically significant, but in the wrong direction. I will test these results for robustness in the next chapter.[75]

[75] *Capability fluctuation*$_{ij}$, and *contiguity*$_{ij}$ are significant at the 10% level, and in the wrong direction

6. Robustness tests

Whenever we are using statistics to study complex and stochastic social phenomena, it is possible that arbitrary and/or theoretically irrelevant properties of the data and research design are influencing our results. This can cause us to make flawed inferences about the causal relationships we seek to uncover or disprove.

Since the results presented in chapter 5 constitute the first attempt at a quantitative study of this question, and since they might be used in future research, we need to make sure that the results are stable. If the results are stable they will not depend on small adjustments to the model specification or research design, on idiosyncratic parts of the dataset, or on influential cases or outliers. All my robustness tests will have a particular challenge to inference as their starting point, and almost all of them will consist of a specific test of whether the problem poses a challenge to the results presented above. I will perform the robustness tests on the results from the efficient model presented in table 5. Results from the robustness tests are listed in the appendix (tables 14-17).

6.1 Highly correlated independent variables

Multicollinearity occurs when two or more independent variables, X_1 and X_2 correlate highly with each other. When this occurs it is hard to disentangle the individual effects of X_1 and X_2. A high degree of multicollinearity might *in some cases* lead to very high standard errors that may tempt us to conclude that there is no significant relationship between the variables when there actually is one (Maddala and Lahiri 2009, 281-282).[76] One way to check for multicollinearity is by calculating the Variance Inflation Factor (VIF). The VIF is defined as:

$$VIF(\beta_j) = \frac{1}{1 - R_j^2}$$

Where R^2_j is the variance of the variable X_j that is accounted for by all the other independent variables in the model (Maddala and Lahiri 2009, 283-284). If a variable is completely determined by a combination of the other independent variables, then we have perfect multicollinearity. To check for this problem I have calculated the VIF for each variable in the efficient model to see if the significance of any of those estimates might be due to

[76] This would be to commit a type II error, by failing to reject a false null hypothesis.

multicollinearity (table 14).[77] I have chosen to follow convention and deem multicollinearity a problem if the VIF exceeds a threshold of 10.[78] I find that multicollinearity is not a great general problem in the model, but *contiguity*$_{ij}$ and the interaction term between *contiguity*$_{ij}$ and *capability fluctuation*$_{ij}$ have VIF`s of concern (9.90 and 10.63 respectively), which is probably due to an expected correlation between contiguity and its interaction term. This has not made the two variables insignificant, but we should show caution when it comes to interpreting their substantive effects.

6.2 Model specification

One important precondition for using a particular regression model is that the relationship between the variables that is assumed in the statistical model and the relationships in the real world correspond to a satisfactory degree. If this is not the case, our analysis will be plagued by biased coefficients (Menard 2010, 106).

One of the assumptions here is that there is correspondence between the *functional form* assumed by the estimator and the actual relationship between the variables. The assumption of logistic regression is that the relationship between the independent variables and the logit of Y is linear (Menard 2010, 106). I have tested for this in two ways. First, I have done a so-called "link test", which tests that the relationship between the independent and the dependent variable can be expressed by a logarithmic function (Pregibon 1980). The test uses the predicted values from the previous model and the squared predicted value as variables in a new model. If the predicted value is not a significant variable in this new model, the model is mis-specified (Statacorp 2009, 849-853). The results from my link test show that a logarithmic link function is appropriate. Second, I have tested all the variables that are not dummy variables for nonlinearity by using the Box-Tidwell transformation (Menard 2010, 108). This procedure adds a term for the variable, X, that we are testing for linearity, which multiplies X with the natural logarithm of X. If this transformed variable is significant when added to the model, this is an indication that the relationship between X and Y is poorly specified (Menard 2010, 108). I have done a Box-Tidwell test for each variable in the efficient model that is not dichotomous.

[77] For a discussion of potential statistical fixes to the problem of multicollinearity, and their related problems, see Maddala and Lahiri 2009, 283-303).

[78] There is a debate about how high the VIF must be before a variable should be dropped or other measures should be taken. O`Brien (2007) is critical of the scholarly convention that a threshold of 10 should be deemed the point at which multicollinearity is a problem. He argues that "Values of the VIF of 10, 20, 40, or even higher do not, by themselves, discount the results of regression analyses" (O`Brien 2007, 673) , and that other factors that also affect the variance should be taken into account (O`Brien 2007) .

This analysis shows that *risk attitude*$_j$ has a significant Box-Tidwell term, and it suggests that the relationship between risk attitude and hierarchy might be non-linear. I test several transformations of this variable and find that a log-transformation produces a better approximation. This does not fundamentally alter the inference made about the effect of *risk attitude*$_j$, and it is thus not considered to be damaging to my results.

6.3 Non-independent observations

Logistic regression assumes that the errors are identically distributed and independent of one another (Glasgow and Alvarez 2008, 516). If the errors of one observation are correlated with the errors of another, we have dependence in our data, and this might lead to incorrect standard errors, endangering the inferences we draw about statistical significance (Beck and Katz 1995). The structure of this dependence might take many forms, and how we choose to deal with dependence in our data depends on what we know about the structure of that dependence. My unit of analysis – alliance decision points – is structured as dyad-years, meaning that each alliance decision point corresponds to the first dyad-year in each bilateral alliance. The possible sources of dependence in dyadic data are complex and many.

First, many of the same *dyads* show up in several different bilateral alliances. To take one example, the United Kingdom and France have been in many alliances with each other over the years. It is not implausible that their decision to ally in a given year is affected by non-modeled factors that are specific to their previous history of being allied. If this is the case, we have dyad-specific clustering in our data, and this might produce incorrect standard errors. A second possible form of dependence is introduced by the fact that many of the same *states* show up more than once in our dataset, in different alliances, and this might introduce unmodeled state-specific dependence in the data. One example might be if the United States` decision to ally with Iraq in 1959 is affected by its decision to ally with Turkey in the same year. A third possibility is that there is temporal dependence in our data, meaning that several of the observations observed at time *t* might be affected by unmodeled events that happened at time *t* or *t-1*. Examples of such events are the First and Second World War and the end of the Cold War. Fourthly, there might be spatial dependence between units, meaning that one unit`s decision of alliance-design with state *j* depends on whether or not its neighbor is in a hierarchical alliance with the same state. All of these forms of dependence are intuitively plausible.

I have chosen to check for dependence in my data in three steps. First I have run the full models and the efficient model with the standard errors clustered on the dyad and clustered on the year, modeling the intuitively plausible possibility that errors are correlated within the same dyads or within the same year. Secondly, I have run the models using unclustered robust Huber-White standard errors, which is a way of correcting for possible heteroskedasticity, clustering and other forms of non-independence when it is hard to determine what form this dependence might take (Zorn 2006). Thirdly, I have run the models with dummies for different time periods, all corresponding to qualitatively different historical phases in IR.[79]

I find that the results are robust to these alterations. None of the significant results lose their significance or change sign when I cluster standard errors on dyads or years, when I use unclustered robust standard errors, nor when I control for the different time periods mentioned. The log-likelihood does not change significantly either. This indicates that the results do not depend on specific dyads, time periods, or other forms of dependence in the data.

6.4 Outliers and influential cases

Influential observations are observations that have a great impact on the results of a regression. Outliers are cases that have an unexpected value of Y given its predicted value in the estimated model. Observations can have a large impact if they have extreme values on the independent variables (influential observations), or if their value on the dependent variable is unusual given the independent variables (outliers) (Menard 2010, 135). Such observations should not drive our results. I check for influential cases by computing the dbeta statistic, which measures the influence of the covariate pattern of a given observation, and is analogous to the Cook`s D statistic used in OLS regression (Hamilton 2009, 286). Outliers are detected by looking at standardized residuals. Here I will categorize outliers as units that have a standardized residual greater than 2 or smaller than -2, and influential observations as observations with an influence (dbeta statistic) greater than 1. I will first inspect the outliers, to see whether these tell us something substantive about our model, and then run the models with outliers and influential cases removed.[80]

The number of outliers is 5, and this is not more than what we would observe if the outliers were random. The cases where the model assigned a high probability of hierarchy (Y=1) and there was a negative outcome (Y=0) are France-Comoros 1978, and Egypt-Yemen

[79] I have run one model with a dummy for the period from the year of Napoleons defeat in 1815 to the time of the national revolutions in 1848, one for the period from 1848 to the outbreak of the First World War in 1914, one for the period from 1914 to the end of World War II in 1945, one for the Cold War from 1945 to 1989, and one for the post-Cold War period after 1989.

[80] These thresholds are arbitrary, but they are both suggested in the literature (Menard 2010, 134-137), and suggested by the residual and dbeta plots I have looked at.

1962. These two cases are actually indicative that our model of independent variables is tracking the concept of hierarchical organization, and they tell us something about the limits of our dependent variable. The Comoros gained independence from France in 1975, but relations between France and the Islands have remained hierarchical after independence (Mukonoweshuro 1990). France retained territorial sovereignty over a part of the island group, and the alliance in 1978 came after a political coup, supported by French funds, mercenaries and military hardware, overthrew the president who had orchestrated the 1975 independence from France (Mukonoweshuro 1990, 559-560). Why this alliance was not organized hierarchically might then be due to the strength of France`s access to *other* instruments to control the Island group, such as economic patronage and the presence of proxy armies in the form of French mercenaries. Egypt and Yemen in 1962 is also a case where the dominant state – Egypt – made an attempt at domination but not through hierarchical alliance design. In 1962, Egypt intervened in the Yemeni civil war, an intervention which, according to Ferris (2008, iii), was an outright product of Egyptian "hegemonic ambitions". Egypt kept a substantial number of forces in Yemen after 1962 (Barnett and Levy 1991, 379), and it is plausible that the fact that a large number of troops were already present at the time of the alliance agreement reduced the need for formalization of Egypt`s military presence, integrated commands or a common defense policy. What both these cases might be telling us is that there may be other, more *informal* ways of maintaining hierarchical safeguards in an alliance, safeguards that are not picked out by our dependent variable. This indicates that a future study should control for other instruments of hierarchical domination.

Cases where the model assigned a low probability of hierarchy (Y=0) and hierarchical alliance design was chosen (Y=1) are United States-Japan in 1960, Russia-China in 1896, and Kyrgyzstan-Uzbekistan in 1992. The large residual for the United-States and Japan is not a big surprise, as the peculiar features of that alliance are direct results of Japan`s defeat in World War II.[81] The Russia-China (1896) case is more of a puzzle, while the Kyrgyzstan-Uzbekistan case might be an outlier due to the particularly turbulent circumstances surrounding the dissolution of the Soviet Union in 1991.

To make sure that my results do not depend on outliers and influential cases, I drop all observations that have a standardized residual greater than 2 or smaller than -2, and that have a dbeta statistic greater than 1, and run all the models without these observations. The results

[81] This suggests that a variable for war between *i* and *j*, or occupation, might have been included.in the model.

of this analysis are listed in the appendix (table 17). This analysis shows that the results seem robust to outliers.

6.5 Alternative operationalization of hierarchy

A robust result should not disappear if we change the operationalization of the variables it depends on in subtle but theoretically irrelevant ways. So, for example, a result showing that X increases the likelihood of war when war is operationalized as a conflict causing at least 1000 battle deaths, should not change in substantial ways when the threshold is lowered to 900 battle deaths. In other words, a result should be fairly robust to alternative but theoretically similar operationalizations. This needs to be tested.

As described in chapter 4, the dependent variable used in the results shown above, is operationalized as 1 if an alliance includes provisions for (A) a common defense policy; *or* (B) an integrated military command during peacetime and wartime; *or* (C) a right to troop placements or bases on the soil of one of the alliance-members while this right is not reciprocal. The common denominator of these components is, as mentioned, that they all signify the ceding of authority by the weaker state. If my results only depend on fine nuances in this operationalization, inferences that are based on them will be less valuable. I have therefore run the models with an alternative, and arguably more coarse, dependent variable where none of the original components of my dependent variable are included, but that still measures the theoretical property of hierarchy. This operationalization is an additive index where each of the following alliance provisions count equally and are given a score of 1: A) Whether the agreement provides for the forces of one party to be subordinated to the forces of another party during conflict,[82] B) whether the alliance agreement specifies the creation of a coordinating organization,[83] C) whether the agreement specifies that one alliance partner can intervene in the internal politics of the other while these commitments are not reciprocal ,[84] D)

[82] This corresponds to the variable SUBORD in the ATOP dataset. SUBORD is coded in the following way: 1= “the agreement provides for subordination and specifies a particular state to command the joint forces”, 2=”If the agreement provides for subordination, but the state in command depends on relevant conditions (for instance, the territory being defended, the state with the larger number of forces involved, etc.)” (Leeds 2005, 28), and as 0 otherwise. In my operationalization only the value 1 on the SUBORD variable gets a score of 1 in the index, since the specification of which state is dominant is more likely to correspond to a hierarchical relationship.

[83] The variable is based on ORGAN1 in the ATOP dataset. ORGAN1 is coded as: 1= “if the alliance agreement provides for regular meetings of governmental officials to manage the agreement”, 2=” If the agreement creates a named organization with regularly scheduled meetings (for instance, an interstate commission for cooperation)”, 3= “If the agreement includes (or is formed as part of) a stand-alone organization with a permanent bureaucracy (e.g., the OAS)” (Leeds 2005, 27), and 0 otherwise. I have coded my variable as 1 if ORGAN1 > 1.

[84] This corresponds to the variable INTERV in the ATOP dataset (Leeds 2005, 31). INTERV is coded in the following way: “1=If the members promise mutual nonintervention in one another’s domestic politics”, 2=”If the

whether the alliance member promises to make its territory or resources available to the ally "in the event of conflict or under other specified conditions relevant to the alliance" (Leeds 2005, 40).[85] This index is an even cruder measure of hierarchical governance than the one I have used in my analysis. Nevertheless, if my original specification is plausibly related to hierarchical organization I expect it to pick up many of the same patterns as my original dependent variable.

To investigate this, I have run OLS regressions with this *hierarchy index* as my dependent variable (table 15). I find that most of the variables that are significant in the models in table 5 are also significant and in the same direction when hierarchy is operationalized with the alternative indicator (see table 15). To summarize, all of the estimates in the efficient model pull in the same direction when I use the alternative operationalization of hierarchical alliance-design, and a majority of these variables are statistically significant. This leads me to conclude that my dependent variable is fairly robust to alternative operationalizations.

6.6 Summary: A second look at the results

The results found in chapter 5 seem to be statistically robust. Multicollinearity does not seem to be a big problem for my model, and tests for systematic error dependence indicate that such dependence does not influence my results. The tests of the functional form of the model indicates that the link function chosen is the right one for the relationships studied, and non-linearity in the log odds of hierarchical organization does not constitute a major problem. Furthermore, the results in my model do not seem to depend on influential cases or outliers, and most of the variables reach statistical significance and all pull in the same direction when tested on an operationally dissimilar but theoretically similar dependent variable measuring hierarchical organization. The fact that the results in the model are stable across this broad variety of robustness tests suggests that the model is a good first-cut at a statistical model of alliance design that can, and should, be used in later studies.

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members promise to intervene in one another's domestic politics under certain circumstances (for instance to protect the regime against rebels)", 3="If the agreement specifies that one or more states can intervene in the internal politics of one or more other states under certain circumstances, but these commitments are not reciprocal, the variable",4= "If one or more states, but not all members, promise not to intervene in the internal affairs of others" (Leeds 2005, 31). I have coded my operationalization as 1 if INTERV==3, and 0 otherwise. have not located the original agreement and do not know whether relevant provisions are included.

[85] This variable is identical to the variable TERRES in the ATOP dataset (Leeds 2005, 40). TERRES is coded as follows: 1=" if any alliance member promises to make some aspect of its territory or resources available to an alliance partner in the event of conflict or under other specified conditions relevant to the alliance." (Leeds 2005, 40), and 0 otherwise.

7. Concluding discussion

- *There is no refutation without a better theory* - Imre Lakatos, 1978[86]

I will here discuss some general interpretations of the results of my analysis. First, I will discuss the non-findings that have led to rejection of hypotheses derived from the transaction-cost theory. Secondly, I will discuss the variables that are successful, and how these results should be interpreted. Both discussions will be coupled with suggestions for further research.

I will argue that there are two patterns in the data that point in somewhat different directions for the transaction-cost argument. The first pattern is that *most* of the transaction-cost variables, as these are operationalized here, explain little of the variation in hierarchical alliance design. Most of the variables I have tested are either not statistically significant, or their effects pull in the opposite direction of what is expected. This is true for the independent performance of the variables, and of their performance when they are tested for interaction with relational specificity. This might be due to the mentioned problems of operationalizing, or to the inherent difficulties of studying cost-benefit calculations statistically. Nevertheless, it is a clear indication that the transaction-cost theory has quite a long way to go before it can be treated as a robust explanatory theory of international security hierarchies.

The second pattern is that a model including successful transaction-cost variables that currently have no other theoretical interpretations, offers a significant improvement on a baseline model of hierarchical alliance-design. It seems that stronger states` fears of entrapment by risk-acceptant weaker allies, institutional dissimilarity and indirect contiguity all make a significant contribution when it comes to predicting *which* alliances will be designed hierarchically. The remaining successful variables in this model are linked to more mainstream brands of IR theory, and their results tell us that previous colonial relationships, and asymmetries in size and material power all push in the direction of hierarchical organization. The combination of these two groups of explanations gives us valuable new knowledge of which factors are decisive in pushing the governance of security relationships in a hierarchical direction, knowledge which is useful to policymakers and future research on this subject. Below, I will go through these patterns in greater detail.

[86] Lakatos 1978, 6

7.1 Non-findings and their implications

I will here discuss some possible interpretations of the negative results, and present issues for further research.

As we have seen, most (not all) of the variables intended to capture behavioral and non-behavioral uncertainty produce results that are either insignificant, or not in line with expectations. The political instability of the weaker state, democracy in the weaker state, and the variables for non-behavioral uncertainty, seem to be unsuccessful predictors of hierarchical alliance-design. This is also the case when they interact with relational specificity. The expected frequency of interaction, when measured as a shared longtime rival, and as the degree of previous security cooperation, does not increase the likelihood of hierarchical cooperation, not even when it interacts with relational specificity. Finally, the transport and monitoring costs entailed by distance, and the coercion, compensation, and self-binding costs entailed by interest divergence do not seem to play an important part in the choice of alliance design. Neither do most of the variables intended to capture relational specificity.

These negative findings have two plausible interpretations. First, they may simply be a consequence of inadequate empirical measures, and the inherent problems that relate to testing the aggregate outcome of cost-benefit calculations when we lack a precise common metric for weighing the various inputs. Second, they may be an indication that there is something wrong with the transaction-cost model, and that it is explanatorily inaccurate. This alternative would be particularly puzzling due to the fact that fears of transaction-costs might even be expected to play *a greater* role in international affairs than in economic exchange because of the lack of credible third-party enforcement. For some variables, the theoretical consequences seem to be more grave than for others, because their operationalizations are less plagued by uncertainty. For instance, if political instability and democracy is related to reliability, as some studies have shown (Gartzke and Gleditsch 2004; Leeds 2003a; Leeds, Mattes, and Vogel 2009) - using very similar operationalizations to mine -, then the fact that democracies and unstable states are no more or less likely to be integrated into hierarchical alliances is a genuine puzzle that warrants closer scrutiny. The fact that direct contiguity is not positively related to hierarchical design, neither independently nor in interaction with uncertainty, is also a puzzling result. Contiguity and strategic location, both emphasized by Weber (2000,23-24), should both be fairly uncontroversial operationalizations of site-specificity. In light of this, the lack of a result here is also puzzling.

These negative findings have three implications for further research. First, greater emphasis should be put on coming up with better operationalizations and data collection efforts related to the central variables in the transaction-cost model. Second, greater attention needs to be devoted to more precise theoretical development of the transaction-cost model, and this should be done with an eye to concrete derivations of hypotheses that are testable in large-N studies. Third, the non-findings that we suspect are least likely to be due to poor operationalization and inaccurate modeling, and that contradict expectations based on previous research, should be investigated more closely. One should drill a little deeper down, perhaps through mechanism-oriented case studies, to investigate why politically unstable states with institutions that are considered to produce unreliable policies are not integrated in hierarchical military alliances. A selection-effect – only the most reliable of the unstable states with democratic institutions are selected as alliance partners – is a possibility here, and this should also be investigated further.

7.2 A tentative case for the transaction-cost theory

In spite of the general pattern of disconfirmed hypotheses, we see that some variables derived from the transaction-cost argument, and that only have an interpretation within this argument, offer substantial predictive and explanatory insight. The results for regime dissimilarity and risk attitude are currently best interpreted within the transaction-cost framework, while colonial contiguity is more uncertain. I will here discuss these results and their implications.

The positive result for regime dissimilarity lends support to the arguments made in Leeds (1999), that it is the *combination* of democracies - who have a high credibility and a low capacity to adjust to sudden external shifts - and autocracies - who have a low credibility and a high capacity to adjust to such shifts - , that explains why dissimilar regimes trust each other less. As far as I can see, there is no other coherent theoretical explanation for this than the one presented by the transaction-cost argument: Dissimilar regimes organize alliances hierarchically to decrease the probability of opportunistic behavior, which is assumed to be higher than when regimes are institutionally similar (Leeds 1999).

The risk attitude of the weaker state also seems to play an important role in the decision to design an alliance with hierarchical safeguards. This indicates that the stronger state`s fear of entrapment might be a motivating factor behind choosing to design an alliance hierarchically. It thus lends support to the theory and evidence presented in Cha`s (2010) case study of U.S. bilateral alliances in Asia, and to the theoretical arguments put forward by Lake (1999, 52,170-172). Since the risk attitude variable is measuring the degree to which the weaker state has an alliance portfolio that maximizes its *regional* security, it can be argued that a positive result here only shows that hierarchical alliance design is chosen to strengthen the defense of a strategically important ally who is regionally isolated and in opposition to the strongest states in that region. On this understanding, hierarchical safeguards are chosen to deter other allies from attacking *j* rather than to prevent *j* from attacking its regional allies and entrapping the stronger state. To test this, I have controlled for the level of threat to the weaker state ($threat_j$). This does not reduce the effect or the significance of the estimate for risk attitude. I will therefore conclude that this alternative interpretation at best offers a *supplementary* interpretation of this estimate, but it does not look like it can replace the transaction-cost interpretation that is forwarded here.

Colonial contiguity has a significant positive association with hierarchical design. As we have seen, this variable measures whether the states in the dyad are indirectly contiguous, meaning that they either border a dependency of the other state, or that one of their dependencies border the dependency of the other state. Inspection of the data shows that almost all of the cases of colonial contiguity are cases where the subordinate borders a dependency of the stronger state. Contrary to risk attitude and regime dissimilarity, there are two reasons why I have lower confidence that this result can be interpreted within the transaction-cost framework. First, it is illogical – given the theoretical argument - that indirect contiguity (colonial contiguity) has a positive effect while direct contiguity does not, since they both proxy site specificity and thus are logically equivalent according to the transaction-cost argument. This indicates that colonial contiguity might be picking up something else.

Secondly, there is a plausible alternative explanation for this result that has some support in the data. This explanation is that colonial contiguity *picks up the instrumental similarity between colonial dominance and hierarchical alliances.* The logic of this argument is that colonial dominance is a particularly harsh and direct form of hierarchical organization, while building a hierarchical alliance is a less direct form, implying that hierarchical alliances are chosen where hierarchical organization is desired but colonization is too costly. On this account, we would expect subordinates in hierarchical alliances with *i* to have similar characteristics to subordinates that are colonial dependencies of *i*, and, given that contiguous states are often similar, we would expect a geographical clustering of subordinate states, some in hierarchical alliances with *i*, some in formal dependency relationships with *i*. This argument is strengthened by the fact that a previous colonial relationship between *i* and *j* has a substantial effect on the likelihood of hierarchical organization, indicating that hierarchical military alliances are chosen as a substitute when strategies of colonial domination have become too costly.

These results and their interpretations indicate that a complete rejection of the transaction cost theory might be unfounded. We should here follow the plea of the philosopher of science Imre Lakatos, who famously argued that a theory should not be regarded as completely rejected until a new one comes along which can explain the empirical pattern predicted by the old theory, while at the same time yielding added explanatory power (Lakatos 1978). Since some of the variables derived from the transaction-cost theory have great explanatory and predictive power, and since no other coherent theory of hierarchical relationships can accommodate these results, the transaction-cost theory, however flawed, is currently better than nothing. Crucially, it offers a substantial improvement on a baseline model of variables that are derived from mainstream brands of IR theory. In short, we can predict and explain more when using the variables derived from the transaction-cost theory and their current interpretation than we can without them, and a theory that can predict and explain *something* is better than a theory that can predict and explain *nothing*. The challenge for future research on this subject is to develop a theory that can explain both the results accounted for by the transaction-cost theory and the results that obtain when we include the variables from the baseline model.

The positive results in this study that can be interpreted by the transaction-cost argument need to be investigated more closely. Both quantitative studies and qualitative mechanism-oriented studies need to investigate whether fears of entrapment by weaker states and regime dissimilarity are driving these results because they represent transaction costs, or whether these results can be interpreted in some other theoretical framework. If these two variables accurately capture transaction-costs, then it should be investigated *why some transaction-costs lead to hierarchical organization and not others.* Finally, a greater emphasis should be put on developing rigorous theoretical alternatives to the transaction-cost model that offer competing testable explanations, and that can move towards integrating the explanations linked to the baseline model with the explanations proposed by the transaction-cost theory. The powerful and robust statistical model identified in this thesis is one place to start, and it should be explored further.

7.3 Summary and conclusions

To summarize, this study leaves us with three important and fruitful contributions to the study of hierarchical security relationships.

First, it has presented a research design that can be used to test one of the very few general theories of hierarchical relationships in international politics. This research design has operationalized the theoretical concepts in the transaction-cost theory by using a range of proxy variables and familiar datasets from the quantitative IR literature. This shows that it is far from impossible to link the concepts in the transaction-cost theory to quantitative measures, in spite of large inherent difficulties when it comes to operationalizing these concepts and modeling their interaction. The research-design presented here does not provide us with an exhaustive and final test of the transaction-cost argument, but it offers a first-cut at a useful framework which can be improved in further studies.

Secondly, I have tested a list of propositions that are derived from the transaction-cost theory. These tests have shown that many of the hypotheses derived from the transaction-cost theory are rejected by the data. Why these variables fail to perform in the expected way might be due to poor operationalization, complexities that are hard to model, or to the fact that the transaction-cost theory is lacking in explanatory power. Overall, these tests indicate that the transaction-cost theory has a long way to go before it can be deemed a robust theory of international security hierarchies.

Thirdly, my thesis has identified a robust statistical model that has large explanatory and predictive power. This model shows that different political institutional characteristics, risk-acceptant weaker states, indirect contiguity, asymmetry of size and power, and former colonial relationships have a great impact on the probability that an alliance will be organized hierarchically. The fact that regime-dissimilarity and the risk attitude of the weaker state have large explanatory power, and that this result currently has no other theoretical interpretation might lend some credence to the transaction cost explanation, and the relationships mentioned need to be investigated further. In addition to the transaction-cost variables, power asymmetry, size and colonial relationships also seem to play a large role in pushing relationships in a hierarchical direction. If we look at the combination of these two groups of variables, it seems that large and powerful states use hierarchical alliance design as an instrument to guard against *some* forms of transactional risks, and as an instrument for dominating former dependencies and smaller and less powerful allies. These results should lead to further theoretical development and research.

In conclusion, the results presented here should be used as inputs to further studies on the nature and variations of international hierarchies. As with all scientific endeavors, this study does not leave the questions posed completely illuminated, but it casts a little more light on the causes of one of the most enduring and important questions of international politics.

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Appendix 1 – Additional results

Table 9 - Overview of missing values

Variable	Missing values	After replacement
risk attitude$_j$	28 of 208	14 of 208
risk-score variance$_{ij}$	21 of 208	6 of 208
interest divergence$_{ij}$	35 of 208	20 of 208
power asymmetry$_{ij}$	35 of 208	11 of 208
size$_j$	9 of 208	7 of 208
democracy$_j$	21 of 208	X
regime dissimilarity$_{ij}$	19 of 208	X
capabilityfluctuation$_{ij}$	4 of 208	X
contiguity$_{ij}$	0 of 208	X
colonial contiguity$_{ij}$	0 of 208	X
previously allied$_{ij}$	0 of 208	X
shared rival$_{ij}$	1 of 208	X
strategic location$_{ij}$	1 of 208	X
fewer allies $_i$	8 of 208	X
distance$_{ij}$	17 of 208	X
colonial history	0 of 208	X
threat$_{ij}$	0 of 208	X
threat$_j$	0 of 208	X
threat$_i$	0 of 208	X

For many of the variables in table 9, like shared rival etc. there are *no* missing observation because all other cases than the ones who are listed in the sets I am merging with get a score of 0. So, if state *j* is not in the Goertz, Diehl and Klein dataset (2006), meaning that they have not registered a rivalry for that state at time *t*, then I will consider their dataset to be exhaustive. This is slightly problematic in that it relies on the assumption that the authors of the merging dataset have coded every case of rivalry. It is nevertheless a necessary assumption to do the analyses.

Table 10 - Univariate tests of independent variables

Variable category	Proxy-variable	Coefficient	p-values
Opportunism	*instability*$_j$	.831	.229
Opportunism	*risk attitude*$_j$	.922	.007
Opportunism	*regime dissimilarity*$_{ij}$	.133	.000
Opportunism	*democracy*$_j$	-.234	.695
Uncertainty	*capability fluctuations*$_{ij}$	-.040	.169
Uncertainty	*risk-score variance*$_{ij}$	-2.190	.129
Frequency	*previously allied*$_{ij}$	-.720	.099
Frequency	*shared rival*$_{ij}$	.112	.791
Specificity	*contiguity*$_{ij}$	-1.133	.004
Specificity	*strategic location*$_{ij}$	-.304	.434
Specificity	*colonial contiguity*$_{ij}$	1.849	.000
Specificity	*fewer allies*$_i$	-.0745	.000
Governance costs	*interest divergence*$_{ij}$	1.638	.000
Governance costs	*distance*$_{ij}$	.767	.000
Control	*wartime*$_{ij}$	.001	.998
Control	*threat*$_{ij}$	.016	.872
Control	*threat* $_j$	.032	.698
Control	*threat* $_i$	.025	.823
Control	*power asymmetry*$_{ij}$	.568	.000
Control	*colonial history*$_{ij}$	2.17	.000
Control	*size*$_j$	-.509	.001

Table 11 - Trivariate tests of interaction terms

	contiguity$_{ij}$	*strategic location$_j$*	*colonial contiguity$_{ij}$*	*fewer allies$_i$*
instability$_j$	-.752(.617)	1.684(.360)	1.243(.481)	.0759(.291)
regime dissimilarity$_j$	-.113(.166)	-.113$^+$(.092)	.0184(.830)	-.002 (.354)
risk attitude$_j$	-.959(.256)	.476(.542)	-.679(.543)	-.0217(.539)
democracy$_j$	2.726*(.031)	-.570(.670)	.796(.606)	.033(.418)
risk-score variance$_{ij}$	1.733(.579)	.439(.883)	3.351(.565)	-.332*(.016)
capability fluctuation$_{ij}$	.148*(.018)	.0117(.858)	-.222(.108)	-.001(.734)
previously allied$_{ij}$	-.016(.986)	-.176(.885)	1.386(.241)	-.065(.137)
shared rival$_{ij}$	.040 (.341)	-.039(.511)	-.053(.382)	.005(.014)

p-values in parenthesis, *= $p < .05$, $^+$= $p < .10$, dependent variable (hierarchy). The models were run with constituent variables of each interaction-term included

Table 12 - Result of inclusion of irrelevant single variables in full model

Variable	Coefficient	p-values
democracy$_j$	-.343	.674
shared rival$_{ij}$	.641	.373
wartime$_{ij}$	-.755	.433
threat$_{ij}$	.308	.116
threat$_j$	-.088	.136
threat$_i$	.352	.538

Table 13 - Inclusion of relevant interaction terms in the full model

Variable	Coefficient	p-value
regime dissimilarity$_{ij}$ *X strategic location*$_{ij}$	-.052	.597
regime dissimilarity$_{ij}$ *X contiguity*$_{ij}$	-.187	.099
democracy$_{ij}$ *X contiguity*$_{ij}$	.808	.552
risk-score variance$_{ij}$ *X fewer allies*$_i$	-.036	.845
capability fluctuationsij X contiguity$_{ij}$	.205	.043
capability fluctuation$_{ij}$ *X colonial contiguity*$_{ij}$	-.259	.221
previously allied$_{ij}$ *X colonial contiguity*$_{ij}$	1.578	.379
previously allied$_{ij}$ *X fewer allies*$_{ij}$	-.094	.097
shared rival$_{ij}$ *X fewer allies*$_{ij}$	.002	.380

the threshold for inclusion in this table is p < .25

Table 14 - Variance inflation factors for variables in efficient model

Variable	**VIF**
risk attitude $_j$	1.16
regime dissimilarity $_{ij}$	1.43
capability fluctuation $_{ij}$	2.02
contiguity $_{ij}$	9.90
colonial contiguity $_{ij}$	1.17
fewer allies $_i$	1.36
colonial history $_{ij}$	1.28
size $_j$	1.23
capability fluctuation $_{ij}$ *X site-specificity* $_{ij}$	10.63

Table 15 - Models with alternative dependent variable operationalization

	Baseline model	Full model	Full model with interaction terms	Efficient model
Oppportunism				
instability$_j$	---	-.037(-0.22)	-.037 (-0.22)	---
risk attitude$_j$	---	.369* (3.25)	.369*(3.25)	.451*(4.60)
regime dissimilarity$_{ij}$	---	.007 (0.86)	.007(0.86)	.0143$^+$(1.79)
Uncertainty				
risk-score variance$_{ij}$	---	.199(0.47)	.199(0.47)	---
capability fluctuation$_{ij}$	---	-.009(-0.97)	-.009(-0.97)	-.0113(-1.26)
Frequency				
previously allied$_{ij}$	---	-.037(-0.037)	-.037(-0.36)	---
Specificity				
contiguity$_j$	---	-.085(-0.31)	-.085(-0.31)	-.215(0.80)
strategic location$_{ij}$	---	-.132(-1.37)	-.132(-1.37)	
colonial contiguity$_{ij}$	---	.453*(3.03)	.453*(3.03)	.430*(3.13)
fewer allies$_i$	---	-.016*(-3.67)	-.016*(-3.67)	-.0159*(-4.21)
Governance costs	---			
distance$_{ij}$	---	.087 (1.16)	.087 (1.16)	---
interest divergence$_{ij}$	---	.226$^+$(1.83)	.226$^+$(1.83)	---
Controls	---			
power asymmetry$_{ij}$	.087* (2.54)	-.065(-1.49)	-.065(-1.49)	---
colonialhistory$_{ij}$	.359*(2.45)	.153(1.12)	.153(1.12)	.185(1.54)
size$_j$	-.036 (-0.79)	-.204*(-3.98)	-.204*(-3.98)	-.144*(-3.75)
Interaction				
capability fluct. X contiguity$_{ij}$	---	.011 (0.83)	.011 (0.83)	.0162(1.17)
N	155	155	155	155
R^2	0.18	0.48	0.48	0.44

*t-statistics in parenthesis, * = significance level of 5%, $^+$ = significance level of 10%, dependent variable= hierarchy index*

Table 16 - Regression with robust standard errors and time dummies

	clustered on dyad	clustered on year	unclustered robust	with time dummies
risk attitude$_j$	1.836*(4.08)	1.836*(3.37)	1.836*(3.87)	2.076*(3.18)
regime dissimilarity$_{ij}$	.118*(2.82)	0.118*(2.62)	.118*(2.85)	.135*(2.47)
capability fluctuation$_{ij}$	-.130*(-2.18)	-0.130*(-2.22)	-.130*(-2.23)	-.168$^+$(-1.83)
contiguity$_{ij}$	-3.083*(-2.19)	-3.083*(-1.97)	-3.083*(-2.21)	-3.589*(-1.96)
colonial contiguity$_{ij}$	3.317*(3.61)	3.317*(3.28)	3.317*(3.53)	3.113*(3.05)
fewer allies$_i$	-.0529*(-2.54)	-.0529*(-2.53)	-.0529*(-2.59)	-.0485$^+$(-1.90)
colonial history$_{ij}$	1.243*(2.12)	1.243*(2.34)	1.243*(2.14)	1.252$^+$(1.84)
size$_j$	-.801*(-2.56)	-.801*(-2.58)	-.801*(2.49)	-.858*(-3.28)
capability fluctuation$_{ij}$ X contiguity$_{ij}$	---	---	---	.215*(2.10)
1814-1848	---	---	---	1.670(0.67)
1848-1914	---	---	---	2.055(1.38)
1914-1945	---	---	---	2.130(1.45)
1945-1989	---	---	---	1.191(0.70)
1989-2003	---	---	---	2.037(1.32)
N	165	165	165	165
Log likelihood	-50.73	-50.73	-50.73	-48.72
Pseudo R^2	0.46	0.46	0.46	0.48

*Z-statistics in parenthesis, * = significance level of 5%, $^+$ = significance level of 10%,*

Table 17 - Models with influential cases and outliers removed

	Efficient model
risk attitude$_j$	2.490*(3.25)
regime dissimilarity$_{ij}$	0.145*(2.30)
capability fluctuation$_{ij}$	-0.207*(2.10)
contiguity$_{ij}$	-5.182*(2.32)
colonial contiguity$_{ij}$	5.820*(3.30)
fewer allies$_i$	-0.097*(-3.00)
colonialhistory$_{ij}$	2.170* (2.70)
Size$_j$	-1.847* (-3.89)
N	161
Log likelihood	- 32.99
Pseudo R^2	0.63

*Z-statistics in parenthesis, * = significance level of 5%, $^+$ = significance level of 10%,*

Appendix 2 – Relevant Stata (v.11) code for all the analyses

Dataset and additional do. files will be provided upon request (contact: torewig@hotmail.com)

Name of the variables in the do. file

hierarchy = hierarchy

$instability_j$ = instability

$risk\ attitude_j$ = riskattitude_j

$regime\ dissimilarity_{ij}$ = regime_diff

$democracy_j$ = democracy_j

$risk\ score\ variance_{ij}$ = riskscorevariance

$capability\ fluctuation_{ij}$ = capabilityfluctuationij

$interest\ divergence_{ij}$ = interest_region_weakmem_swt

$contiguity_{ij}$ = contiguity

$colonial\ contiguity_{ij}$ = colcontig

$previouslyallied_{ij}$ = previouslyallied

$shared\ rival_{ij}$=shared

$strategic\ location_{ij}$ = rivalcontiguityij

$fewerallies_i$ = fewerallies_stronger

$distance_{i\,j}$= kmdist_log

$colonial\ history_{ij}$ = colonialhistory

$power\ asymmetry_{ij}$ = CINC_diff

$threat_{ij}$ = threat_total_log

$threat_j$ = threat_weaker_log

$threat_i$ = threat_stronger_log

$size_j$ = size_weakmem

$wartime_{ij}$ = wartime

```
. use "M:\pc\Dokumenter\Masterprosjekt\data\Datasett\bearbeidede sett\correlatesofsubordination.dta"
```

////////////EXCLUDING MISSING VALUES/////////

```
logit hierarchy  instabilityj riskattitude_j regime_diff democracy_j riskscorevariance capabilityfluctuationij interest_region_weakmem_swt contiguity colcontig previouslyallied shared rivalcontiguityij fewerallies_i kmdist_log colonialhistory CINC_diff threat_weaker_log threat_stronger_log threat_total_log size_weakmem

predict missing1
drop if missing1==.
```

/////////////////////////////////UNIVARIATE TESTS//////////////////////

```
/*1.  The control variables*/

logit hierarchy wartime
logit hierarchy threat_total_log
logit hierarchy threat_weaker_log
logit hierarchy threat_stronger_log
logit hierarchy CINC_diff
logit hierarchy colonialhistory
logit hierarchy size_weakmem

/*2. Opportunism*/

logit hierarchy instabilityj
logit hierarchy democracy_j
logit hierarchy regime_diff
logit hierarchy riskattitude_j

/*3.  Non-behavioral uncertainty*/

logit hierarchy capabilityfluctuationij
logit hierarchy riskscorevariance

/*4.  asset-specificity*/
```

```
logit hierarchy contiguity
logit hierarchy colcontig
logit hierarchy rivalcontiguityij
logit hierarchy fewerallies_i

                    /* 5 frequency*/

logit hierarchy previouslyallied
logit hierarchy sharedrival


                    /*6  governance costs*/

logit hierarchy kmdist_log
logit hierarchy interest_region_weakmem_swt


 ///////////////////////////////INTERACTION EFFECTS///////////////////////////////////////

                    ///*regime dissimilarity X specificity variables*///

logit hierarchy regime_diff contiguity regimedif_contiguity
logit hierarchy regime_diff rivalcontiguityij regimedif_rivalcontiguityij
logit hierarchy regime_diff colcontig regimedif_colcontig
logit hierarchy regime_diff fewerallies_i regimedif_fewerallies

                    ///*risk attitude_j X specificity variables*///

logit hierarchy riskattitude_j contiguity risk_contiguity
logit hierarchy riskattitude_j rivalcontiguityij risk_rivalcontiguityij
logit hierarchy riskattitude_j colcontig risk_colcontig
logit hierarchy riskattitude_j fewerallies_i risk_fewerallies

                    ///*instabilityj X specificity variables*////

logit hierarchy instabilityj contiguity instabilityj_contiguity
logit hierarchy instabilityj rivalcontiguityij instabilityj_rivalcontiguityij
logit hierarchy instabilityj colcontig instabilityj_colcontig
logit hierarchy instabilityj_fewerallies instabilityj fewerallies_i

                    ///*Risk-score varianceij X specificity variables*///

logit hierarchy riskscorevariance contiguity riskscorevariance_contiguity
logit hierarchy riskscorevariance colcontig riskscorevariance_colcontig
logit hierarchy riskscorevariance rivalcontiguityij riskscorevariance_rivalcontiguityij
logit hierarchy riskscorevariance fewerallies_i riskscorevariance_fewerallies
```

```
////*capabilityfluctuationij X specificity variables*////

logit hierarchy capabilityfluctuationij contiguity capabfluct_contiguity
logit hierarchy capabilityfluctuationij colcontig capabfluct_colcontig
logit hierarchy capabilityfluctuationij rivalcontiguityij capabfluct_rivalcontiguityij
logit hierarchy capabfluct_fewerallies capabilityfluctuationij fewerallies_i


////*previouslyallied X specificity variables*////

logit hierarchy previouslyallied_contiguity previouslyallied contiguity
logit hierarchy previouslyallied_colcontig colcontig previouslyallied
logit hierarchy previouslyallied_rivalcont previouslyallied rivalcontiguity
logit hierarchy previouslyallied_fewerallies previouslyallied fewerallies_i

////*shared rival X specificity variables*////

logit hierarchy shared_contiguity shared contiguity
logit hierarchy shared_colcontig shared colcontig
logit hierarchy shared_rivalcontiguity rivalcontiguity shared
logit hierarchy shared_fewerallies shared fewerallies_i


///////INCLUSION OF VARIABLES FROM THE FIRST TESTS IN FULL MODEL OF RELEVANT
VARIABLES, TABLE 12 ////////////////////////

////single variables/////

logit hierarchy instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij
previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i
interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store full1

logit hierarchy democracy_j instabilityj regime_diff riskattitude_j riskscorevariance
capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i
interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store full_democracy
lrtest full1

logit hierarchy sharedrival instabilityj regime_diff riskattitude_j riskscorevariance
capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i
interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store full_sharedrival
lrtest full1
```

logit hierarchy wartime instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store full_wartime

lrtest full1

logit hierarchy threat_total_log instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff_log colonialhistory size_weakmem

estimates store full_threat

lrtest full1

logit hierarchy threat_stronger_log instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff_log colonialhistory size_weakmem

estimates store threat_stronger_log

lrtest full1

logit hierarchy threat_weaker_log instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff_log colonialhistory size_weakmem

estimates store threat_weaker_log

lrtest full1

///////INCLUSION IN FULL MODEL, OF INTERACTION TERM ABOVE P > .25 THRESHOLD FROM THE FIRST RELEVANCE TESTS, TABLE 13///

logit hierarchy regimedif_rivalcontiguityij instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy regimedif_contiguity instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy democracy_contiguity instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

```
logit hierarchy uncertainty_fewerallies instabilityj regime_diff riskattitude_j democracy_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy capabfluct_contiguity instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy capabfluct_colcontig instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy previouslyallied_fewerallies instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy previouslyallied_colcontig instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

logit hierarchy shared_fewerallies instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

/////////////////////////////////////////////////BACKWARD EXCLUSION OF MODEL OF IRRELEVANT VARIABLES//////////////////////////////////////////

logit hierarchy instabilityj capabfluct_contiguity  regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store m1

logit hierarchy instabilityj capabfluct_contiguity  regime_diff riskattitude_j capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store m2

lrtest m1

logit hierarchy capabfluct_contiguity  regime_diff riskattitude_j capabilityfluctuationij previouslyallied contiguity colcontig  rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem
```

estimates store m3

lrtest m2

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij previouslyallied contiguity colcontig fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store m4

lrtest m3

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij previouslyallied contiguity colcontig fewerallies_i interest_region_weakmem_swt kmdist_log colonialhistory size_weakmem

estimates store m5

lrtest m4

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig fewerallies_i interest_region_weakmem_swt kmdist_log colonialhistory size_weakmem

estimates store m6

lrtest m5

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig fewerallies_i interest_region_weakmem_swt colonialhistory size_weakmem

estimates store m7

lrtest m6

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

estimates store m8

lrtest m7

lrtest m1

//////////////////////MODELS IN TABLE 5//

logit hierarchy instabilityj regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem estimates store full

estat class

logit hierarchy instabilityj capabfluct_contiguity regime_diff riskattitude_j riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig rivalcontiguityij fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store full_samspill

estat class

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

estimates store redusert

estat class

logit hierarchy colonialhistory size_weakmem CINC_diff

estimates store basic

estat class

//////////////////SIMULATED PROBABILITIES (CLARIFY) – TABLE 5//////////////////////////////

estsimp logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

setx mean

simqi , listx

setx riskattitude_j max (capabfluct_contiguity regime_diff capabilityfluctuationij contiguity contiguity colcontig fewerallies_i colonialhistory size_weakmem) mean

simqi , listx

setx regime_diff max (riskattitude_j capabfluct_contiguity capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem) mean

simqi, listx

setx colcontig max (regime_diff riskattitude_j capabfluct_contiguity capabilityfluctuationij contiguity fewerallies_i colonialhistory size_weakmem) mean

simqi, listx

setx capabilityfluctuationij max (regime_diff riskattitude_j capabfluct_contiguity colcontig contiguity fewerallies_i colonialhistory size_weakmem) mean

simqi, listx

setx contiguity max (capabilityfluctuationij regime_diff riskattitude_j capabfluct_contiguity colcontig fewerallies_i colonialhistory size_weakmem) mean

simqi, listx

setx colonialhistory max (regime_diff riskattitude_j capabfluct_contiguity capabilityfluctuationij contiguity colcontig fewerallies_i size_weakmem) mean

simqi, listx

setx size_weakmem max (capabilityfluctuationij regime_diff riskattitude_j capabfluct_contiguity colcontig colonialhistory fewerallies_i colonialhistory) mean

simqi, listx

setx fewerallies_i max (capabilityfluctuationij regime_diff riskattitude_j capabfluct_contiguity colcontig colonialhistory capabfluct_contiguity colonialhistory) mean

simqi, listx

setx capabfluct_contiguity max (capabilityfluctuationij regime_diff riskattitude_j size_weakmem colcontig colonialhistory fewerallies_i colonialhistory) mean

simqi, listx

setx (riskattitude_j colcontig regime_diff) max (threat_total_log capabfluct_contiguity capabilityfluctuationij contiguity colonialhistory) mean

simqi, listx

setx (colonialhistory threat_total_log size_weakmem) max (capabfluct_contiguity capabilityfluctuationij contiguity riskattitude_j colcontig regime_diff) mean

simqi, listx

setx (colonialhistory threat_total_log size_weakmem) max (capabfluct_contiguity capabilityfluctuationij contiguity riskattitude_j colcontig regime_diff) mean

simqi, listx

drop if atopid==.

```
/////MODELS IN TABLE 7////

logit hierarchy riskattitude_j regime_diff colcontig

estat class

logit hierarchy colonialhistory size_weakmem CINC_diff riskattitude_j regime_diff colcontig

estat class

logit hierarchy colonialhistory size_weakmem CINC_diff

estat class

/*generating roc curves for figures 5 and 6*/

logit hierarchy regime_diff riskattitude_j colcontig

lroc

logit hierarchy colonialhistory size_weakmem CINC_diff

lroc

//////////VARIANCE INFLATION FACTORS, TABLE 14//////////////////////////////////////

regress hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij
contiguity colcontig  fewerallies_i colonialhistory size_weakmem

estat vif

////////ALTERNATIVE DEP. VAR OPERATIONALIZATIONS, TABLE 15////////////////////////////

gen subord1=.

replace subord1=1 if subord==1

replace subord1=0 if subord !=1

gen confederation=.

replace confederation=1 if orgpurp1==4

replace confederation=0 if orgpurp1!=4

gen hierarchyindex=.

replace hierarchyindex=subord1+interv1+organize+terrres

regress hierarchyindex  CINC_diff colonialhistory size_weakmem
```

estimates store hierarchyindex_basic

regress hierarchyindex instabilityj rivalcontiguityij capabfluct_contiguity riskattitude_j regime_diff riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store hierarchyindex_full

regress hierarchyindex instabilityj rivalcontiguityij capabfluct_contiguity riskattitude_j regime_diff riskscorevariance capabilityfluctuationij previouslyallied contiguity colcontig fewerallies_i interest_region_weakmem_swt kmdist_log CINC_diff colonialhistory size_weakmem

estimates store hierarchyindex_fullsamspill

regress hierarchyindex capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

estimates store hierarchyindex_efficient

////////////////////////////TEST OF THE LINK FUNCTION///////////////////////////

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

linktest

////////////////////////////BOX TIDWELL TESTS//

generate riskattitudej_box=.

replace riskattitudej_box=riskattitude_j*ln(riskattitude_j+1)

logit hierarchy riskattitudej_box capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

generate regimedif_box=.

replace regimedif_box=regime_diff*ln(regime_diff+1)

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff regimedif_box capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem

generate capabilityfluctuationij_box=.

replace capabilityfluctuationij_box=capabilityfluctuationij*ln(capabilityfluctuationij+100)

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij capabilityfluctuationij_box contiguity colcontig fewerallies_i colonialhistory size_weakmem

```
generate fewerallies_box=.

replace fewerallies_box=fewerallies_i*ln(fewerallies_i+100)

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i fewerallies_box colonialhistory size_weakmem

generate size_box=.

replace size_box=size_weakmem*ln(size_weakmem+100)

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem size_box

generate CINC_diff_box=.

replace CINC_diff_box=CINC_diff*ln(CINC_diff)

logit hierarchy CINC_diff capabfluct_contiguity riskattitude_j regime_diff
capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory size_weakmem
CINC_diff_box

///////MODELS WITH ROBUST STANDARD ERRORS, TABLE 16///////////////////////

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem , robust

estimates store reduced_robust

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem , cluster(dyad)

estimates store reduced_clustered

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem , cluster(year)

estimates store reduced_clusteredyear

///////////MODELS WITH TIME-PERIOD DUMMIES, TABLE 16/////////////////////////

generate time1=.

replace time1=1 if year > 1814 & year < 1848

replace time1=0 if year > = 1848

label variable time1 "From Vienna to 1848"

generate time2=.
```

```
replace time2=1 if year > 1848 & year < 1914

replace time2=0 if year > = 1914 | year < =1848

label variable time2 "From 1848 to WWI"

generate time3=.

replace time3=1 if year > 1914 & year < 1946

replace time3=0 if year > = 1946 | year < = 1914

label variable time3 "From WWI to end of WWII"

generate time4=.

replace time4=1 if year > 1948 & year < 1989

replace time4=0 if year < = 1948 | year > = 1989

label variable time4 "Cold War"

generate time5=.

replace time5=1 if year > = 1989

replace time5=0 if year < 1989

label variable time5 "post Cold War"

logit hierarchy time1 time2 time3 time4 time5 capabfluct_contiguity riskattitude_j
regime_diff capabilityfluctuationij contiguity colcontig fewerallies_i colonialhistory
size_weakmem

//////OUTLIERS AND INFLUENTIAL OBSERVATIONS (TABLE 17 + RESIDUAL ANALYSIS//////////

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig  fewerallies_i colonialhistory size_weakmem

predict pred2

predict dx2b, dx2

predict db2, dbeta

predict rs2 , rs

graph twoway scatter db2 pred , mlabel(atopid)

graph twoway scatter dx2b pred , mlabel(atopid)
```

```
graph twoway scatter db2 rs, mlabel(atopid)

graph twoway scatter  rs pred, mlabel(atopid)

generate outlier=.

replace outlier=1 if rs2 > 2 | rs2 < -2

replace outlier=0 if rs2 < 2 & rs2 > -2

replace outlier=. if rs2==.

replace outlier=. if rs2==.

drop if atopid==.

generate influential=.

replace influential=1 if db2 > 1

replace influential=0 if db2 <=1

list atopid stateabb_mem1 stateabb_mem2 year hierarchy if outlier==1

list atopid stateabb_mem1 stateabb_mem2 year hierarchy if influential==1

list atopid stateabb_mem1 stateabb_mem2 year hierarchy if outlier==1 & influential==1

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem if outlier==0 &
influential==0

estimates store reduced_outlier

///////OUT-OF-SAMPLE PREDICTIVE TESTS (K-FOLD CROSS VALIDATION, TABLE 8///////////

/*each procedure has to be repeated 10 times for each predictive test – this means that the
memory must be cleared for each time, and the relevant commands in the do.file above
must be run again for each time*/

///////////////////*efficient model – repeat 10 times*////////////////////////////////////

generate rannum = .

replace rannum = uniform()

sort rannum

generate grp = .

replace grp = 0 in 1/40
```

```
replace grp = 1 in 41/81

replace grp = 2 in 82/121

replace grp = 3 in 122/162

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem if grp!=0

predict total_gruppe0

logit hierarchy total_gruppe0 if grp==0

estat class

lroc

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem if grp!=1

predict total_gruppe1

logit hierarchy total_gruppe1 if grp==1

estat class

lroc

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem if grp!=2

predict total_gruppe2

logit hierarchy total_gruppe2 if grp==2

estat class

lroc

logit hierarchy capabfluct_contiguity riskattitude_j regime_diff capabilityfluctuationij
contiguity colcontig fewerallies_i colonialhistory size_weakmem if grp!=3

predict total_gruppe3

logit hierarchy total_gruppe3 if grp==3

estat class

lroc

////////*Risk attitude, regime dissimilarity, colonial contiguity – repeat 10 times*//////////
```

```
generate rannum = .

replace rannum = uniform()

sort rannum

generate grp = .

replace grp = 0 in 1/40

replace grp = 1 in 41/81

replace grp = 2 in 82/121

replace grp = 3 in 122/162


logit hierarchy regime_diff riskattitude_j colcontig if grp!=0

predict tc_gruppe0

logit hierarchy tc_gruppe0 if grp==0

estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig if grp!=1

predict tc_gruppe1

logit hierarchy tc_gruppe1 if grp==1

estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig if grp!=2

predict tc_gruppe2

logit hierarchy tc_gruppe2 if grp==2

estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig if grp!=3

predict tc_gruppe3
```

```
logit hierarchy tc_gruppe3 if grp==3
estat class
lroc
////////////*colonialhistory, size, powerasymmetry – repeat 10 times*//////////////
generate rannum = .
replace rannum = uniform()
sort rannum
generate grp = .
replace grp = 0 in 1/40
replace grp = 1 in 41/81
replace grp = 2 in 82/121
replace grp = 3 in 122/165

logit hierarchy colonialhistory size_weakmem CINC_diff if grp!=0
predict cont_gruppe0
logit hierarchy cont_gruppe0 if grp==0
estat class
lroc
logit hierarchy colonialhistory size_weakmem CINC_diff if grp!=1
predict cont_gruppe1
logit hierarchy cont_gruppe1 if grp==1
estat class
lroc
logit hierarchy colonialhistory size_weakmem CINC_diff if grp!=2
predict cont_gruppe2
logit hierarchy cont_gruppe2 if grp==2
```

```
estat class

lroc

logit hierarchy colonialhistory size_weakmem CINC_diff if grp!=3

predict cont_gruppe3

logit hierarchy cont_gruppe3 if grp==3

estat class

lroc

/////combined tc and control model – repeat 10 times/////////////////////

generate rannum = .

replace rannum = uniform()

sort rannum

generate grp = .

replace grp = 0 in 1/40

replace grp = 1 in 41/81

replace grp = 2 in 82/121

replace grp = 3 in 122/165


logit hierarchy regime_diff riskattitude_j colcontig colonialhistory size_weakmem CINC_diff
if grp!=0

predict conttc_gruppe0

logit hierarchy conttc_gruppe0 if grp==0

estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig colonialhistory size_weakmem CINC_diff
if grp!=1

predict conttc_gruppe1

logit hierarchy conttc_gruppe1 if grp==1
```

```
estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig colonialhistory size_weakmem CINC_diff if grp!=2

predict conttc_gruppe2

logit hierarchy conttc_gruppe2 if grp==2

estat class

lroc

logit hierarchy regime_diff riskattitude_j colcontig colonialhistory size_weakmem CINC_diff if grp!=3

predict conttc_gruppe3

logit hierarchy conttc_gruppe3 if grp==3

estat class

lroc

///////CONTROLLING RISK ATTITUDE FOR THREAT TO J, (CHAPTER 7)////////

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig  fewerallies_i colonialhistory size_weakmem

logit hierarchy capabfluct_contiguity regime_diff riskattitude_j capabilityfluctuationij contiguity colcontig  fewerallies_i colonialhistory size_weakmem threat_weaker_log
```